FIRST AERO WEEKLY IN THE WORLD

FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

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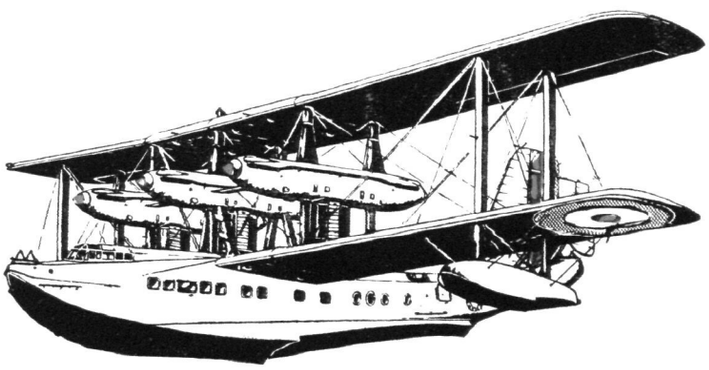
Vol. XXV
No. 48

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

SIXPENCE
EVERY THURSDAY



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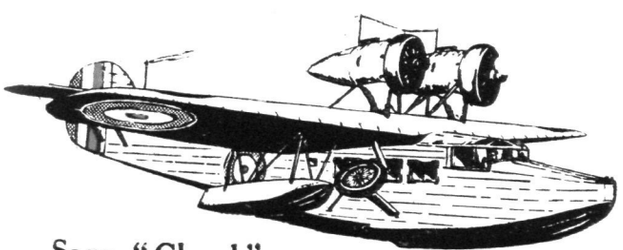

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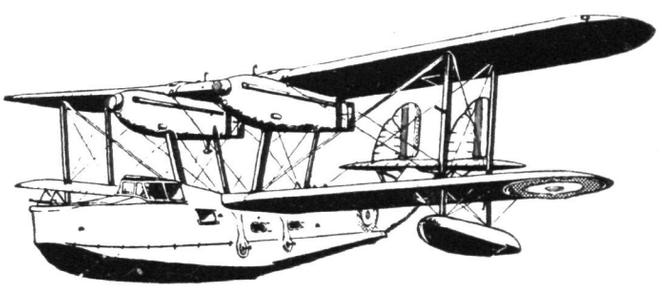
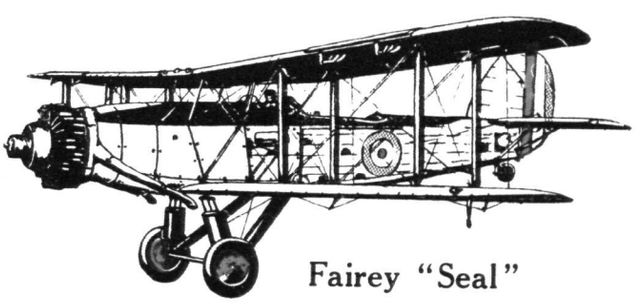


Vickers Supermarine "Scapa"

Vickers "Vildebeest"



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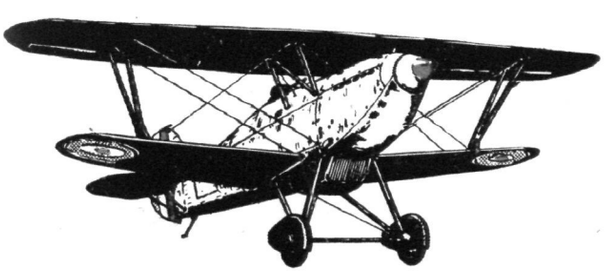
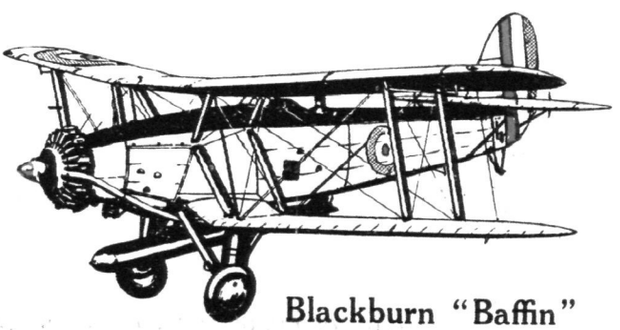


Hawker "Super-Fury"



Blackburn "Baffin"

FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

First Aeronautical Weekly in the World. Founded January, 1909

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice and Progress of Aerial Locomotion and Transport

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DIARY OF CURRENT AND FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list:—

1933.

Nov. 30. "Tail Buffeting." Lecture by Dr. W. J. Duncan before R.Ae.S.
Dec. 1. No. 3 Sqdn. R.F.C. and R.A.F. Reunion Dinner, at May Fair Hotel.
Dec. 1. No. 70 Sqdn. R.A.F. Reunion Dinner, at R.A.F. Club, Piccadilly.
Dec. 1. Martlesham Annual Dinner.
Dec. 1. Lancashire Ae.C. Annual Ball, Midland Hotel, Manchester.
Dec. 1. Hampshire Ae.C. Annual Dinner and Dance, South Western Hotel, Southampton.
Dec. 1. Leicestershire Ae.C. Dance, at Palais de Danse, Leicester.
Dec. 2. De Havilland Works Annual Dinner, First Avenue Hotel, London.
Dec. 6. A.I.D. Approved Inspectors' Dinner, Royal Victoria Hotel, Sheffield.
Dec. 7. "Possible Future Development of Aircraft Engines." Lecture by A. H. R. Fedden before R.Ae.S.
Dec. 8. Calshot Reunion Dinner, at R.A.F. Club, Piccadilly, W.1.
Dec. 8. Airports Conference, Mansion House.
Dec. 13. London Ae.C. Annual Dinner and Dance, Park Lane Hotel.
Dec. 14. "Light Alloys for Aeronautical Purposes." Lecture by Dr. L. Aitchison before R.Ae.S.
Dec. 15. Close of entries for International Touring Competition (1934), Poland.
Dec. 18-24. International Rally at Cairo and Meeting of the F.A.I.
Dec. 28. Irish Ae.C. Annual Dance, Gresham Hotel, Dublin.
Dec. 29. Liverpool and Dis. Ae.C. Annual Ball, Grosvenor Hotel, Chester.

EDITORIAL COMMENT

WE are not so insane as to want more wars or anything which may make for war, and if we believed that disarmament would make the prospect of war more remote we should be firm advocates of disarmament. We agree, however, with Mr. Baldwin that disarmament will not prevent war. Only the removal of the will to fight can do that. Consequently we are not unduly distressed at the prospect that the Disarmament Conference is not likely to effect much in the way of disarmament. What we do regret is that the said Conference has not done more than it has done in the way of drawing up rules for the humane conduct of warfare. What the world now fears more than anything else is that in the next war aircraft may be used for deliberate attacks on civil populations. If the Disarmament Conference had done anything definite to reduce that fear it would have justified its existence. Something has been done, we admit, though we are not clear as to its extent, and certainly the world in general has not been sufficiently reassured on that point.

Levelling Up

The question was brought up in the House of Commons the other day, when the Home Secretary (Sir J. Gilmour) was questioned as to the steps which the Government was taking to protect the civil population against possible air attack. The answer was a quotation from the same speech of Mr. Baldwin from which we also quoted above, namely, that the Government has been making investigations quietly and without publicity, and the additional information was extracted that the measures applied not only to London but to the whole country. To a further question about the desirability of the people being given some idea as to what was expected of them, no answer was returned.

It is a commonly known fact that the Government has been making a complete study of the subject of gas. Not to have done so would have been, in Mr. Baldwin's words, criminal negligence. We need all possible information about the steps which can nullify a gas attack, and also we need to be prepared

to take reprisals if that should unfortunately be necessary. We do firmly believe that sensible rules of war will generally be observed by belligerents, and history supports us in this view. For instance, during the great war no combatant used dum-dum bullets, and prisoners of war were generally treated in accordance with international rules on the subject. No *deliberate* attacks were made on civil populations on either side by air raids, and poison gas was not dropped on the residential suburbs of London. There is therefore every reason to believe that if Geneva emphatically forbids air attacks of that nature, the rules will be respected.

The one danger is from a "mad dog" nation which, possibly from despair, possibly from arrogance and belief in the policy of "frightfulness," may throw honour to the winds and do what it has solemnly promised not to do. Such a nation can only be restrained by fear of reprisals, and Great Britain must be in a position to inflict such reprisals if she should suffer from a breach of rules. If any enemy nation should attempt to destroy the civil population of London one night, it must know that an even more terrible fate will befall its own capital on the next night. Such a prospect is likely to make even a "mad dog" nation reflect that honesty is the best policy.

Of course, it is not to be inferred from that example that it would be an easy matter, or even a possibility, to wreak widespread destruction on London or any other part of Great Britain. We must have our air defence force, and it must be a great deal stronger in numbers than it is at present. We have made it quite clear that we are not going to disband that force unless and until it has been made quite certain that in no circumstances can civil aeroplanes be used to bomb us. As such an assurance cannot be made, we shall continue to take measures for our own protection. But we must have more squadrons, particularly squadrons of fighters. Following on the questions in the House of Commons, to which we have alluded, Capt. Balfour asked the Under-Secretary for Air whether, if other nations do not come down to our suggested level in aircraft, we shall level up? Sir Philip Sassoon would not commit himself, and asked for notice of that question. He must, of course, speak in accordance with the general policy of the Government, but it is very doubtful whether it would not be best for Great Britain to make a frank declaration of her intentions. It is a national failing to be loath to speak about prospects which at a given moment are considered unpleasant, and an increase of fighting forces now comes under that heading. Many good authorities hold that if in 1914 we had boldly declared that if France were attacked and Belgium invaded we should go to war with Germany, there would have been no war. So, probably, the greatest service which we could do now to forward the cause of peace in Europe would be a frank declaration that we intended to be in a position to defend ourselves. At present the idea has certainly got about that if other nations just keep on talking, Great Britain will go on disarming, and proclaiming her virtue in doing so, until she ceases to carry any weight at all.

We must level up our Air Force. We must, at least, have those extra 10 squadrons which were thought necessary for Air Defence of Great Britain in 1923, and then we must consider what else is necessary in 1934. If the pacts signed at Geneva to regulate warfare are not to be regarded as binding unless they are backed by threats of reprisals, so pacts forbidding war will not be of much use unless the attacker knows that the defence will be stalwart. He who would bomb Great Britain must know that he will plunge his hand into a veritable hornets' (now called "Furies") nest.

❖ ❖ ❖ ❖

"Down Under" Likewise

Australia also is realising the need to strengthen her defences, and particularly her air defences. It is stated by the *Melbourne Herald* that £438,000 is to be spent in the near future on new landplanes and seaplanes (some of the latter will probably be amphibians) for the Royal Australian Air Force. The details are not yet published, but there will certainly be considerable re-equipment and there may be a totally new squadron. The paper states that £62,000 is available for landplanes and £376,000 for seaplanes and equipment.

The above is very satisfactory, but when we also learn that the Australian Government also proposes to spend large sums on coast-defence guns and on a new naval sloop, we are inclined to wonder whether even more should not have been set aside for aircraft. Of course, Australia must have some sea forces and some land forces, and we cannot forget how very valuable her land forces were to the Empire in the Great War. At the same time, we cannot help feeling that the R.A.A.F. will give the Commonwealth the best value for any money spent on defence. With her enormous coast line and her small population, it seems to us that almost the first requisite in her defence forces is mobility, and no force is so mobile as an air force. We write subject to correction by greater authorities, but it does appear to us that, owing to the special geographical circumstances of Australia, big guns for coast-defence work are about the most useless form of defence in which she could indulge. No enemy would choose to attack just at the spot where those guns could fire at him, when there was an infinite choice of other spots at which to land and so take the fortresses in the rear.

Australia's most sure defence will lie in the British naval base at Singapore, but if for any reason she were to be attacked and could not count on help from Singapore, surely her next best form of defence would be by the aircraft of the R.A.A.F. It is obvious that any attack must come from overseas, and must have long sea lines of communication. Such lines of communication would be very vulnerable, very tempting objects for air attack, and the only defence possible for the invaders would be by means of aircraft carriers. The issues of such a combat would depend on the strength of the two air forces engaged, but if that issue were even doubtful, the invaders would feel themselves in a very parlous position. The days are past when a William of Normandy can land in a foreign country and then dismiss his base and his lines of communication from his thoughts. He had no wish to return. The invaded country was to become the home of himself and his army. A modern invader must have lines of communication or he must be overwhelmed. Even without the help of Singapore, a really strong Australian Air Force could so threaten the communications of any invader that an invasion must become a very remote possibility.

AN EARLY "LEOPARD MOTH": The machine entered by Sir Derwent Hall Caine and flown by the late Mr. Styran in the 1933 King's Cup Race. (FLIGHT *Photo.*)

DE HAVILLAND "LEOPARD MOTH"

WHEN the de Havilland Aircraft Co., Ltd., produced the first batch of six "Leopard Moths," three of which took part in the King's Cup Race and one of which won the race, piloted by its designer, Capt. Geoffrey de Havilland, it was known that these six machines were the forerunners of a new standard de Havilland model. The six machines have been flown fairly hard between last July and the present time, and so the experience accumulated before the final details of the production model were settled has been fairly extensive. This should mean that the production machines should be without those minor "snags" which can be so irritating to customers, and which may in exceptional cases be serious enough to mar the future of a new type. The first production "Leopard Moth" was finished a short time ago, but as the purchaser has not yet made up his mind about the colour scheme, the second production model was actually the first to go into the air, which it did early this week. The following notes and sketches, etc., were prepared from the production machines, but time did not permit us to include photographs of the actual production machine, and the two photographs published herewith show the winner and third respectively in the King's Cup Race. The changes made in the production model are not great, and would not be noticeable except by very careful inspection of the machines themselves.

DE HAVILLAND "LEOPARD MOTH"

"Gipsy Major" Engine

Dimensions

	ft.	in.	m.
Length o.a.	24	6	7,47
Length folded	26	6	8,08
Wing Span	37	6	11,43
Folded width	12	6	3,81
Height o.a.	8	9	2,67
Wing area (gross)	206 sq. ft. (19,12 m²)		
Area of ailerons (total)	19·6 sq. ft. (1,82 m²)		
Area of centre section	20 sq. ft. (1,86 m²)		
Area of folding flaps	21·4 sq. ft. (1,99 m²)		
Area of fin	4·34 sq. ft. (0,40 m²)		
Area of rudder	7·69 sq. ft. (0,71 m²)		
Area of tailplane	14·32 sq. ft. (1,33 m²)		
Area of elevators	13·30 sq. ft. (1,24 m²)		

Weights

	lb.	kg.
Tare weight (bare)	1,300	590
Removable equipment	41	19
Normally equipped tare wt.	1,341	610
Petrol 35 gals. (159 litres)	263	119
Oil (2 gals. 9 litres)	20	9
Pilot	160	73
2 passengers at 160 lb.	320	145
Luggage	122	55
Max. total weight	2,225	1 010
Normal gross weight	1,850	840
Aerobatic gross weight	1,750	795

Performance

Max. speed at sea level (1,850 lb. gross) 141·5 m.p.h. (228 km./h.)
Max. speed at sea level (2,225 lb. gross) 140 m.p.h. (225 km/h.)
At 5,000 ft. (1 525 m.) 137 m.p.h. (221 km./h.) and 134·5 m.p.h. (217 km./h.)
At 10,000 ft. (3 060) m.) 131·5 m.p.h. (211 km./h.) and 127·5 m.p.h. (205 km/h.)
Cruising speed at 1,000 ft. 120 m.p.h. (193 km./h.)
Rate of climb (sea level) 850 ft./min. (4,33 m./sec.) and 625 ft./min. (3,19 m./sec.)
Time to climb to 5,000 ft. (1 525 m.) 7 min. and 9·5 min.
Time to climb to 10,000 ft. (3 060 m.) 16 min. and 23·5 min.
Absolute ceiling 21,500 ft. (6 560 m.) and 17,300 ft. (5 280 m.)
Service ceiling 19,000 ft. (5 800 m.) and 14,500 ft. (4 420 m.)
Petrol consumption at cruising speed 5·9 gal./h. = 20·4 miles per gallon.
Maximum range, still air, 715 miles (1 150 km.)

Although resembling the famous "Puss Moth" a good deal in outward appearance, the "Leopard Moth" differs from the earlier machine both in structural features and in the layout of the seating accommodation. Whereas the "Puss Moth" was primarily a two-seater, with provision for an occasional third seat, the "Leopard Moth" is fundamentally a three-seater, with pilot in front and the two passengers side by side behind him. The cabin furnishings are extremely comfortable and of attractive appearance, and the view is, thanks to the generous window area and the inverted "Gipsy Major" engine, very good indeed. In the matter of external appearance the "Leopard Moth" differs from the "Puss Moth" mainly in that its monoplane wing is strongly tapered in plan view, while the undercarriage struts do not run to the top longerons, but to points down the sides of the cabin.

Structurally, the main difference is that the "Leopard Moth" has an all-wood fuselage, while that of the "Puss Moth" was of welded steel tube construction. The wing construction also differs in details, but not greatly in the general principles adopted.

After some years' experience of metal construction, the de Havilland Aircraft Co., Ltd., came to the conclusion that there was, after all, much to be said for the old wood construction. Generally speaking, it was found that whenever a machine was produced in metal, it proved heavier than the corresponding wooden machine, and also in most cases a good deal dearer. When the firm produced the "Fox Moth" there were those who regarded this machine as a retrograde step, because it was made entirely of wood except for a few highly stressed steel fittings. But the answer to the critics was that the "Fox Moth" had an amazing ratio of gross to tare weight, and that it could be sold at a competitive price,

neither of which could have been realised had the machine been of metal construction. In the "Leopard Moth" similar structural principles have been employed, although the fact that the machine is a strut-braced monoplane has necessarily led to certain detail changes.

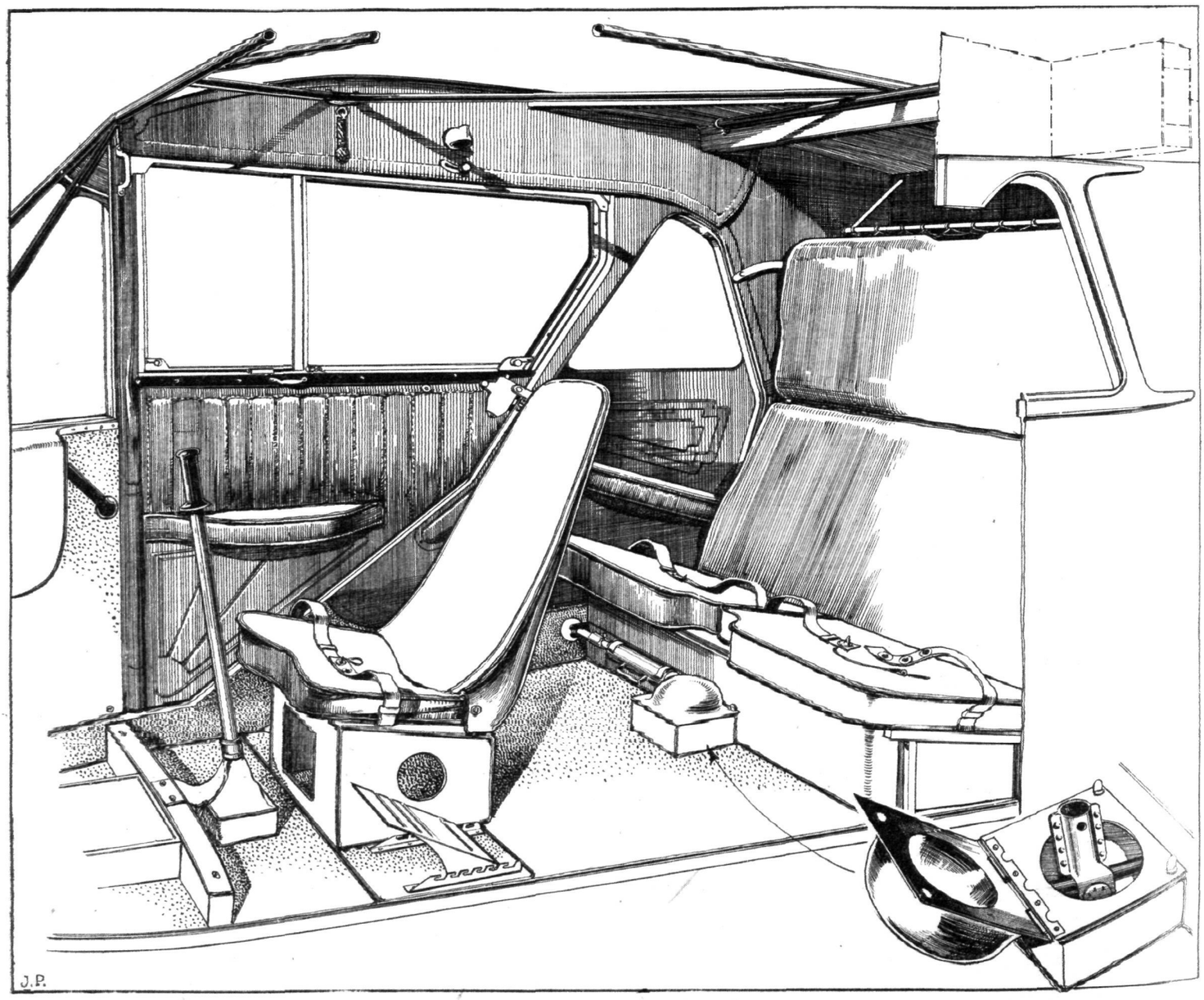
The fuselage of the "Leopard Moth" has a light skeleton of spruce, with a covering of plywood. The sides are flat, but the deck and bottom are cambered. The bottom of the primary fuselage structure is flat, but under it run lengthwise two floor bearers or stringers, which project below the level of the longerons. The outer covering of the bottom is fabric, and here and there in the fuselage bottom are large inspection holes. The fabric is laced on in the vicinity of these holes, so that a portion of it can be turned back and the fuselage structure inspected through the holes in the plywood bottom. The space between the longitudinal bottom stringers is made use of for housing the controls, which are thus readily accessible for inspection and adjustment, but protected by the inner plywood bottom and the outer fabric covering.

The fuselage is built in two sections, which meet on a solid bulkhead behind the cabin, and are joined together by bolts through the longerons. Cupped steel washers are used under the bolt heads and nuts, so that the wood can shrink quite an appreciable amount without slackness developing.

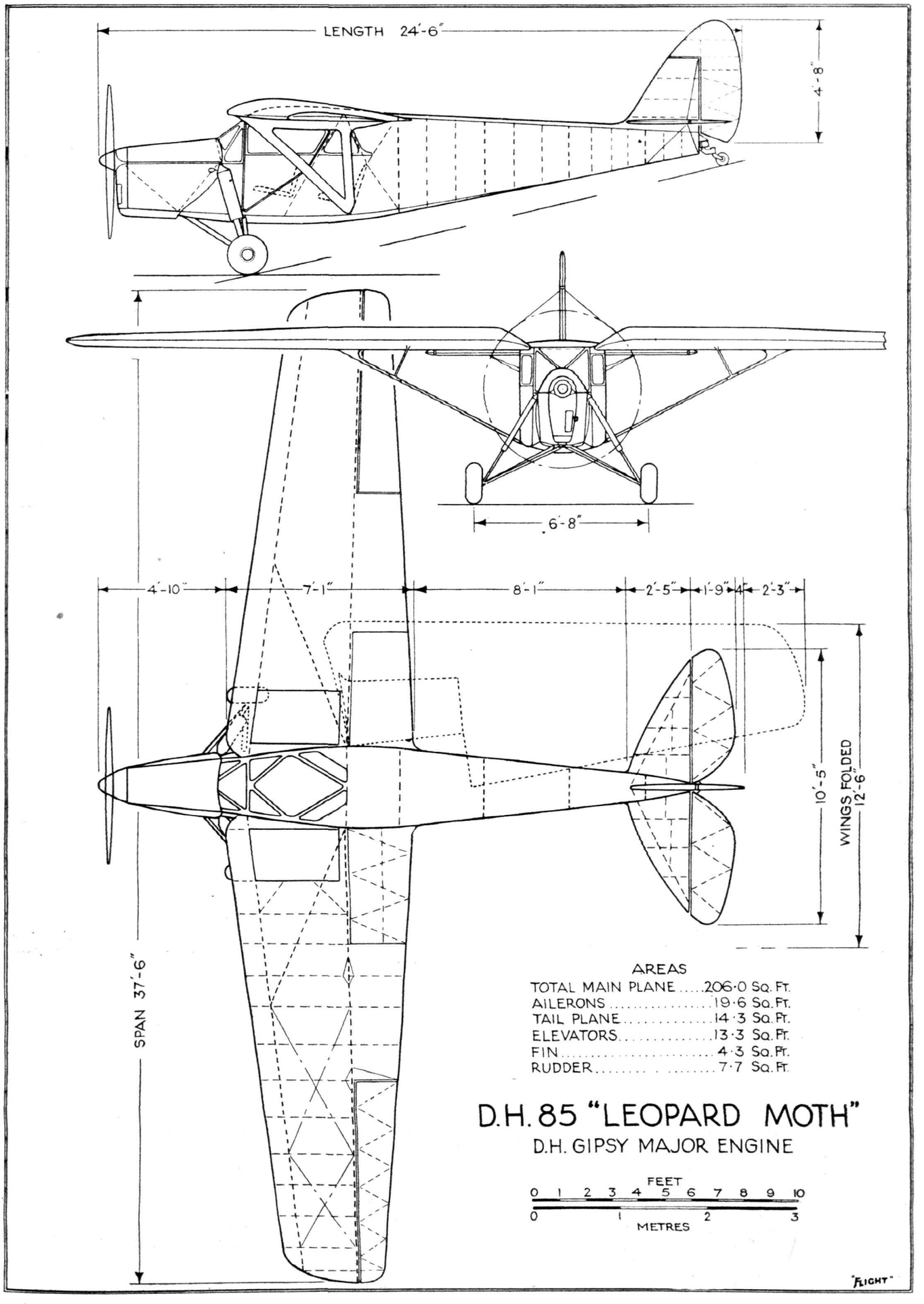
In the wing construction also spruce and plywood are the chief structural materials. The two spars are of box type, with spruce flanges and plywood walls. The leading edge is covered with plywood, and the inner half of the wing is covered with plywood on the lower surface, from the wing root to the wing strut attachments. The wing ribs in the inner portion have spruce flanges and solid plywood webs. The drag member is in the form of a stout spruce beam, some 2 in. square, which runs from the inner end of the rear spar to the wing strut attachment on the front spar. This strut lies at the bottom of the wing section and is glued to the under surface plywood covering. The petrol tanks are placed in this part of the wing.

Bracing of the wing is by streamline-section steel-tube struts, hinged at their lower ends to the fuselage and attached to the wing by steel fittings. In order to "bury" the joint of the struts to the wing, plywood "boxes" are taped on after the wing fittings are in place, and "gaiters" with curved upper ends fair the struts into these "boxes." The wings are designed to fold, and the locking device on the front spar is illustrated by two photographs. When the locking catch has been turned, the locking pin is withdrawn by means of a cable lying inside the wing and terminating at its outer end in a ring which projects from the lower wing covering where the wing struts join the wing. From this position the pilot is well placed for folding the wing when the catch is released. To permit the folded wings to clear the top of the fuselage, the inner portions of the trailing edge are hinged upwards.

The undercarriage of the "Leopard Moth" is of the divided type, the vee struts being hinged at their upper ends to fittings on a stout wooden member on the bottom centreline of the fuselage. The telescopic legs are hinged to the sides of the fuselage, and are used as air brakes by



THE CABIN OF THE "LEOPARD MOTH": Comfortable seating is provided for two passengers side by side. The rear set of controls is removable. (FLIGHT *Sketches.*)



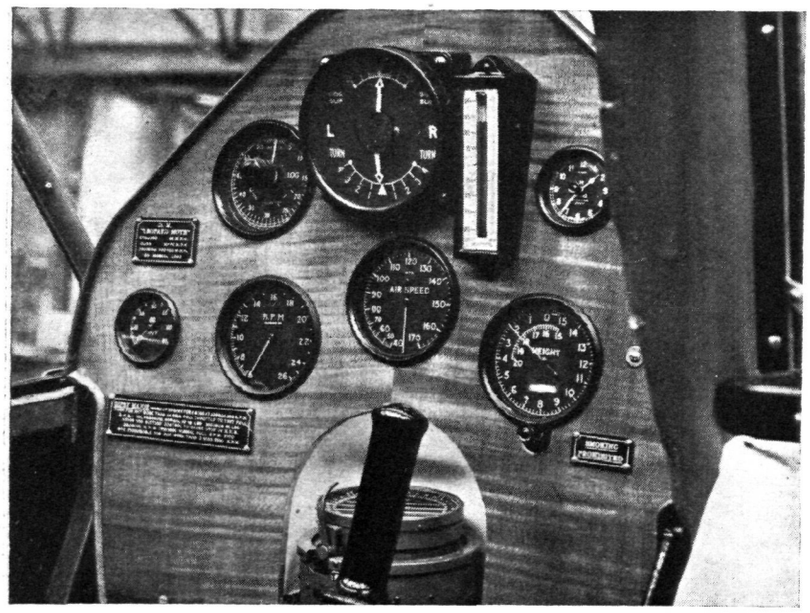
THE DE HAVILLAND "LEOPARD MOTH": General arrangement drawings, to scale.

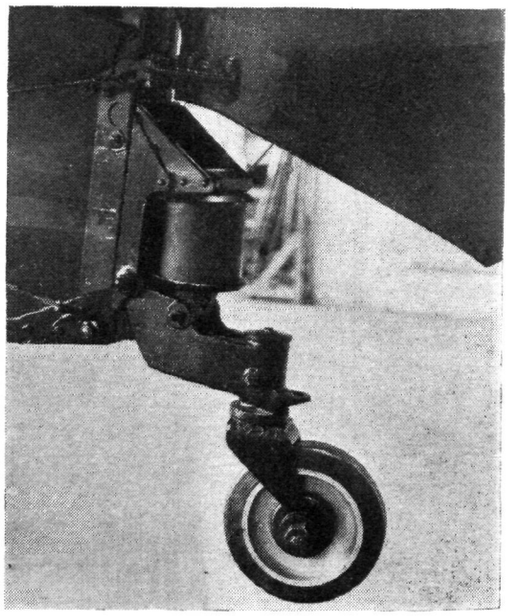
THE PROTOTYPE : The " Leopard Moth " which won the King's Cup Race this year, piloted by Capt. de Havilland himself. The production model does not differ in outward appearance from this machine. (FLIGHT *Photo.*)

being turned " broadside on." This is done by a transverse shaft which ends, like the upper ends of the telescopic legs, in toothed quadrants. The operating handle is on the right-hand side of the cabin. Dunlop wheels and brakes are fitted, and under the tail is a fully-castering tail wheel.

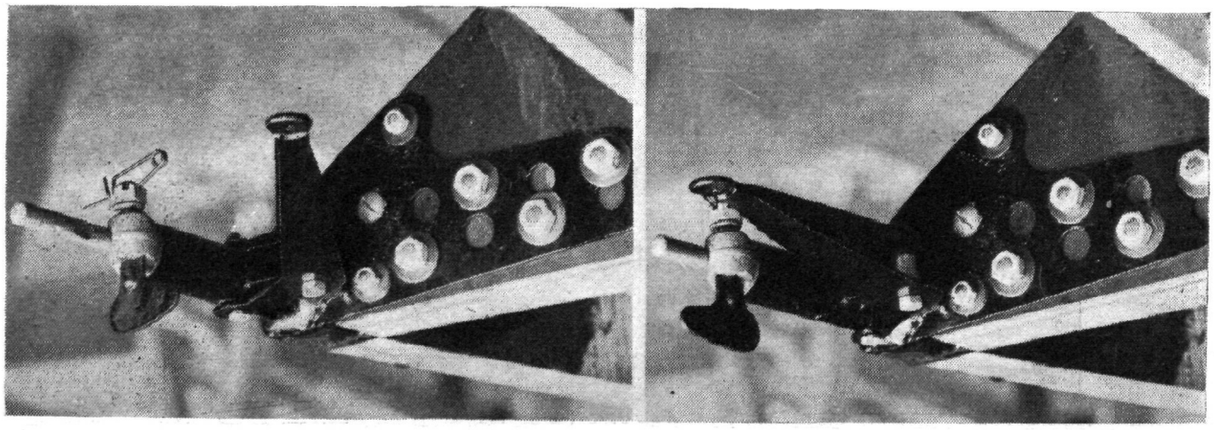
A steel-tube framework of square-section tubes supports the " Gipsy Major " engine, which is neatly cowled in. The wing tanks give gravity feed to the carburetter. An oil tank is placed transversely across the fuselage, behind the engine bulkhead.

In the matter of performance, the " Leopard Moth " appears to be remarkably " clean." For example, the Everling " High-speed Figure " has a value of **30.5**, which is far and away above the average. This figure relates speed to power and wing area, and a high value means that for the particular wing area the power used to attain the speed is low. The fuselage must obviously be of good





A NEAT INSTRUMENT BOARD : The panel carries Smith's instruments, a Reid & Sigrist turn indicator, a Hughes compass, and an air log. On the right, the tail wheel has a solid rubber tyre, and is free to rotate through 360 deg. Springing is by rubber in compression. (FLIGHT *Photo.*)



SECURING THE WING FOLDING : A spring-loaded plunger passes through the forked end on the spar and through the eyebolt on the fuselage. When the plunger is sent home it is locked by turning the tap which engages with the notch on the plunger shown in the left-hand photograph. (FLIGHT *Photos.*)

shape, and the amount of interference between wings and fuselage must be very small indeed.

The cleanness of the machine is also reflected in the other performance figures, and it is interesting to record that the gliding angle is 1 in 12. When the air brakes are "on," this is lowered to a gliding angle of 1 in 9. The length of run to take off is 140 yd. at normal weight and 215 yd. at maximum gross weight. The take-off times are 12 sec. and 17 sec. respectively. By using the wheel brakes the landing run is reduced to 105 yd. and 140 yd. for the two loadings. The stalling speed is 45-50 m.p.h.

From the point of view of structural efficiency, the "Leopard Moth" appears to be of average "goodness." When the machine is fully equipped, the tare weight is 1,341 lb. As the maximum permissible gross weight for "Normal" C. of A. is 2,225 lb., the ratio of gross to tare weight is 1.66, so that the machine carries 66 per cent. of its own weight as disposable load. In view of the fact that the machine is a monoplane, this must be regarded as a satisfactory figure.

A glimpse of the obvious

AIR Ministry Notice to Airmen, Series A, No. 84, relates to the loading of aircraft for particular flights. It is a somewhat peculiar document in that it neither admonishes nor recommends. It is probably intended to do the latter, although the expression "it is recommended" does not occur in it. After pointing out that on each C. of A. it is stated that the maximum authorised weight for the aircraft corresponds to certain standard atmospheric conditions, the Notice calls attention to a fact which quite a few operators of aircraft have long suspected, namely, that lower barometric pressures or higher temperatures will result in depreciation of take-off and climb. The authorities have also made the startling discovery that "the reduction of performances due to atmospheric conditions can, within certain limits, be off-set by reduction in the total weight of the aircraft." The Notice concludes with the positively brilliant statement that "The total weight at which an aircraft is taken off should always be such that:—(*a*) the length of run required for the aircraft to "unstick" is not more than half the available runway in the line of flight, (*b*) the aircraft retains a reasonable rate of climb, and (*c*) the maximum weight laid down in the Certificate of Airworthiness is not exceeded." If the machine should reach the far side of the aerodrome without "unsticking," this is an indication that the load is too great for the particular atmospheric conditions obtaining at the time and place, and the pilot should remove some of the load and try again. If that doesn't do the trick he should either enlarge the aerodrome, put on bigger wings, or write home for a supercharged engine.

Grouping of French aircraft firms

OBVIOUSLY, it is the intention of M. Cot, the French Minister for Air, to concentrate the French aeronautical industry into four or five groups. M. Cot may be able to lay down conditions to the aerial transport companies, but the manufacturers show a more independent spirit, and so far little has been settled with them. It has lately been rumoured that the grouping of the Breguet, Morane, Hanriot, Couzinet and Wibault-Penhoët interests has been planned. The latest news is that the Breguet and Couzinet companies have been united. The Hanriot Company withdrew some time ago from the S.G.A. owing to the financial difficulties encountered by this group. The most important Hanriot machine of this year is a pusher single-seater fighter monoplane. It seems that the predominating company in any consolidation which may take place among the aforementioned firms will be the Société Breguet. The Breguet-Couzinet merger was not totally unforeseen, for the two firms have co-operated in the design of a machine with a range of 1,250 miles, fitted with four Gnome-Rhone K.14 engines. The fitting of these engines is somewhat striking, as it was thought that Renault was a shareholder of Couzinet, while the Breguet concern generally uses Hispano engines in its products. M. Couzinet has experienced a certain amount of difficulty in getting his designs materialised, but now with the Breguet firm to assist him it seems he will be able to produce some remarkable aircraft. Both the Breguet and Couzinet works seem active at present. Couzinet, it is reported, has received an order for five or six three-engine machines (40-h.p. Salmson), which will be used for training the crews of large multi-engined aircraft. Another machine with three Pobjoy engines, the Couzinet 100, is being tested at Villacoublay. It should not be long now before the completion of the large wooden Couzinet machine, with four Hispano-Suiza 12N.b. engines. The Breguet "cyclogyro" will shortly resume test flying at Villacoublay.

Baragwanath crash Inquest

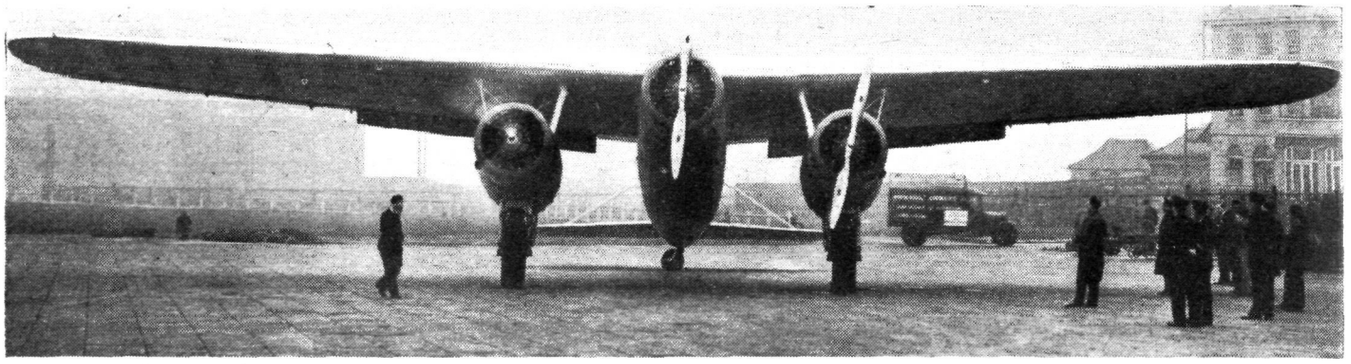
THE finding of the Board of Inquiry, detailed to sit on the accident at Baragwanath on September 26, which resulted in the death of Maj. Cochran-Patrick, D.S.O., M.C., and Sir Michael Oppenheimer, was given at the Magistrate's Court, Johannesburg, on Saturday, November 4. The finding of the Court was "The board finds there is not sufficient evidence before the Board to enable it to state definitely the cause of, or the responsibility for, the accident to aircraft Z.S.A.E.F. at Baragwanath on September 26, 1933."

A new Marcel-Bloch touring machine

A FOUR-SEATER touring aircraft, known as the Bloch 100, fitted with a 165-h.p. Hispano-Suiza engine (Wright licence), has been developed by the Marcel-Bloch Company from the "92" and "93" type monoplanes. The new machine, which is fitted with side-by-side dual controls, is expected to sell at 110,000 francs (£1,375), and will shortly make test flights.

VALUE : The de Havilland "Moth Major," a wooden "Moth" with "Gipsy Major" engine, will be the standard "Moth" for 1934, and is being marketed at the remarkably low price of £695, fully equipped. It has a maximum speed of 112 m.p.h.

Air Transport & Commerce.



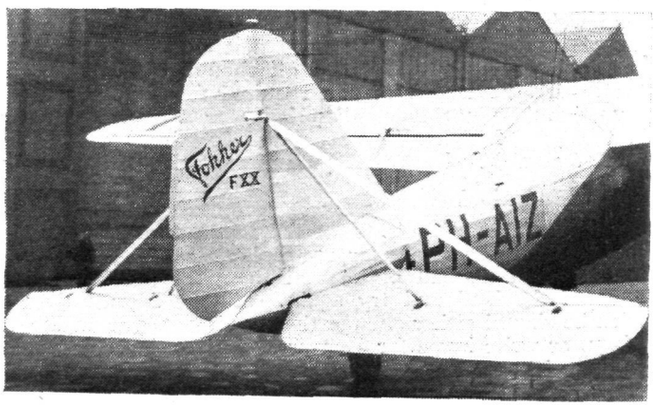
CLEANNESS : That the F.XX has a top speed of 186 m.p.h. can be well believed when looking at this view. The trailing edge flaps, here seen lowered, take 9 m.p.h. off the landing speed. (FLIGHT *Photo.*)

NEW MACHINES FOR K.L.M.

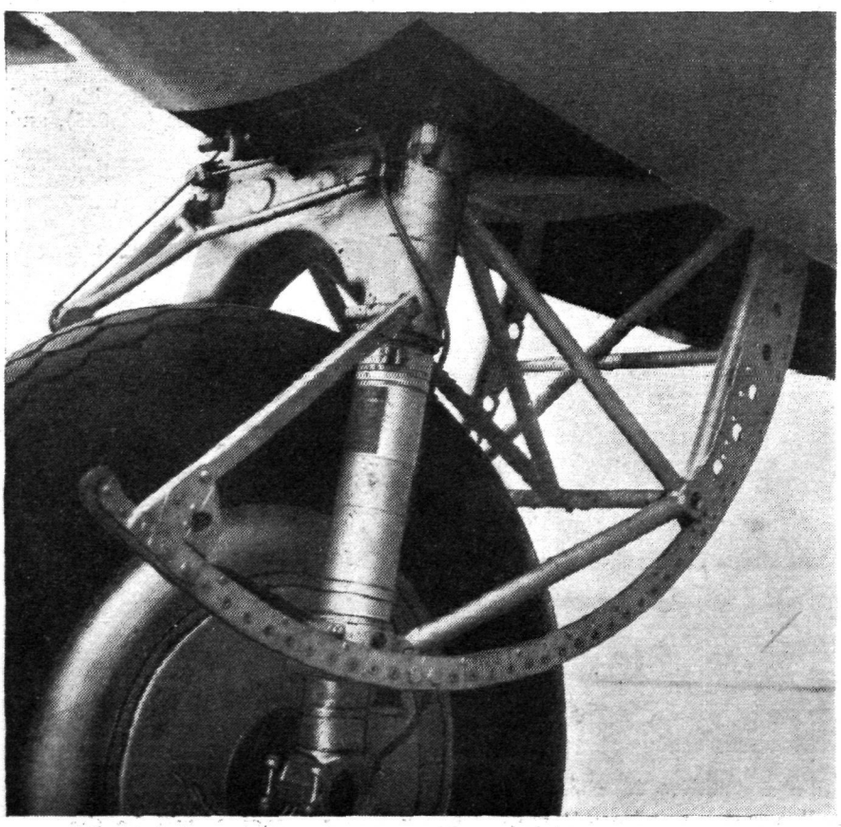
THE Fokker F.XX, *Zilvermeeuw* (" Silver Swallow "), fitted with three Wright " Cyclone F " engines, is now temporarily in service on the Amsterdam-London route. The machine made her first trip to Croydon last Thursday, when, carrying both passengers and mails, she took the place of the usual F.XII. Leaving Schipol (Amsterdam) at 9.25, the F.XX made a short stay at Rotterdam on the way. Even so, the trip to Croydon took but 1 hr. 45 min., which means an average speed of 160 m.p.h. Smirnoff, the pilot, said he had the engines throttled back to keep them in good condition for a trip to Batavia on December 18. On this occasion the *Zilvermeeuw* will be used as a supplementary machine to carry the Christmas mail. It is hoped to make the journey in five days, which is two days less than the time taken by the F.XII's and F.XVIII's which normally are used for the Batavia service. In the summer of next year the machine will operate the London-Amsterdam-Berlin service.

It was foggy at Croydon on Thursday, so the F.XX was unable to demonstrate her high performance to advantage. Although fitted with trailing edge flaps, she seemed to " float " for some distance when coming in to land. Certainly she is fast. As the result of lengthening the engine nacelles and making other improvements, the speed has been raised by 5 m.p.h. since the machine was built. The top speed is given as 186 m.p.h., with a cruising speed of 154 m.p.h. This latter figure, for such a high top speed, seems on the low side. It is rather interesting to compare the speed of the F.XX with that of the American Boeing 247 ten-passenger monoplane (two " Wasps "). In top speed the American machine is about 4 m.p.h. slower than the Fokker. But her cruising speed is 16 m.p.h. higher!

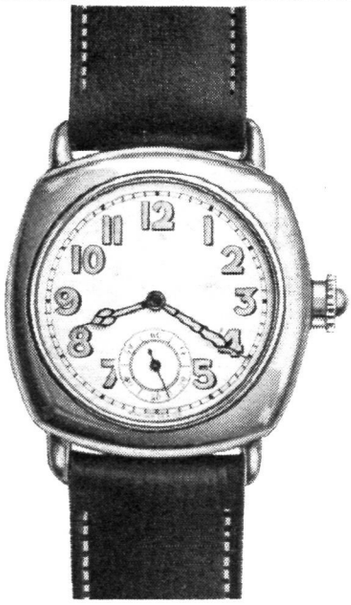
Like most machines fitted with powerful American engines driving metal airscrews, the machine is somewhat noisy when heard from the ground. We are assured, however, that for the passengers she is the least noisy of all the K.L.M. fleet. Double walls, lined with a very effective sound proofing material, are used for the cabin.



THE EMPENNAGE : The tail plane is strut braced on the top side only. In the older Fokkers bracing was used above and below the tail plane. A retractable tail wheel is fitted. (FLIGHT *Photo.*)



A COSMOPOLITAN UNDERCARRIAGE : British Dunlop wheels and brakes, and French Messier oleo legs retract into nacelles behind the American engines of this fast Dutch machine. (FLIGHT *Photo.*)



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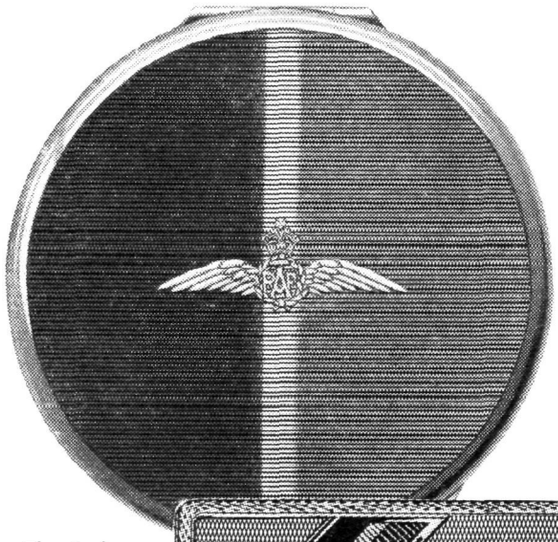

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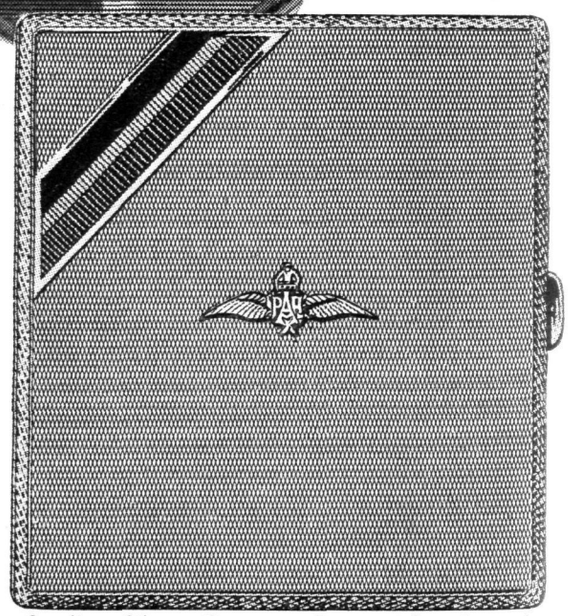

Sterling Silver Cigarette Case, with colours in Enamel and mounted with badge in Sterling Silver. Size $3\frac{1}{4} \times 3\frac{5}{8}$ ins. **£3.5.0**

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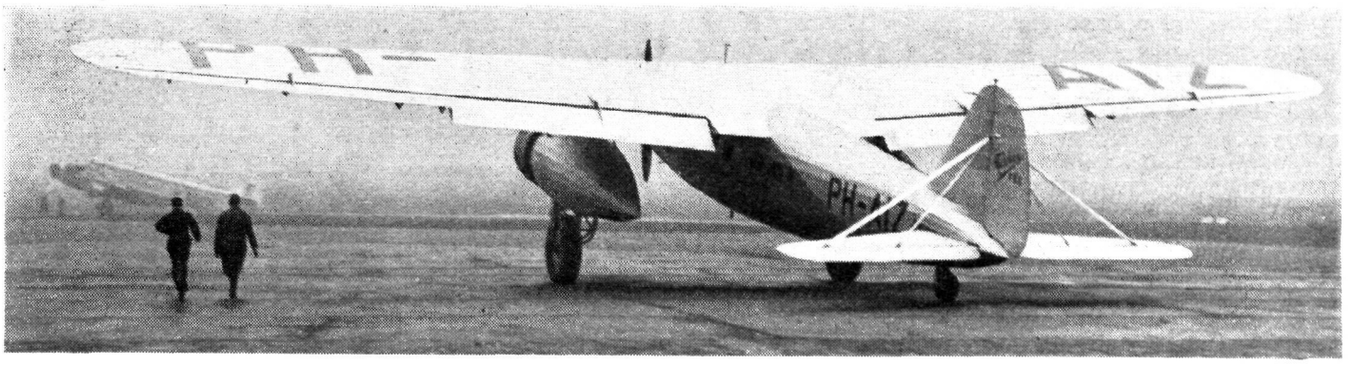


LOW DRAG : The nacelles of the Fokker F.XX are faired to an unusual length. (FLIGHT *Photo.*)

The careful placing of the two outboard engines also contributes to the quiet of the cabin, and we understand that conversation can be carried on in quite an ordinary tone of voice.

Although a certain amount of comfort has been sacrificed to speed, the F.XX retains the majority of excellent features found in the cabins of Fokkers of slower types. The seats we found comfortable enough, but these are later to be replaced by seats of the type used in the F.XII and F.XVIII machines for long-distance flying.

Two large four-engined Fokker passenger machines are being built for K.L.M. These will seat from 32 to 36 passengers. Pratt & Whitney "Wasp" engines will be fitted to one, and Wright "Cyclones" to the other. In both cases the engines are to be mounted in the leading edge of the wing. Present Fokker practice is to sling the engines below the wing. During the past year satisfactory results have been obtained by raising the two "Cyclone" engines of an F.VIII into nacelles in the leading edge. The experience gained during this experiment is being applied to the design of the new four-engined aircraft. It seems that the hanging of pairs of engines in tandem below the wings (as in the Fokker F.32) has been abandoned in favour of the new arrangement. Rumours have been current of late that the two new machines will be fitted with retractable undercarriages. It now seems doubtful if these will be incorporated after all. Speeds in the neighbourhood of 150 m.p.h. are expected.

NEARING AUSTRALIA

ANOTHER link in the chain of Empire airlines which will, ultimately, provide regular air communication to all parts of the Empire, is to be forged with the departure of the Indian air mail from London on Saturday, December 9. After proceeding over the existing 7,200-mile route to Egypt, Karachi, Calcutta and Rangoon, the service will fly on, for the first time, over a new 1,500-mile extension from Rangoon to Singapore, accomplishing in ten days a journey which by the fastest surface transport occupies 20 days. An additional import will be imparted to this inaugural flight owing to the fact that it has been found possible to arrange for the service to carry Christmas mails from this country to the Straits Settlements. This will mean that those who assemble at Singapore to welcome the arrival of the machine completing the first regular air link with London will also have the satisfaction of being able to receive, by this initial flight, seasonable greetings from their relatives and friends in the homeland. The first return flight from Singapore to London is due to leave Singapore on December 31, and will reach London on January 10. The inclusive postal rate for letters from London to Singapore and the Straits Settlements area is 11d. per half-ounce, and 11d. for each additional half-ounce. The passenger fare from London to Singapore has been fixed at £180.

AIR SERVICES IN SCOTLAND AND IRELAND

IT was reported a short while ago that proposals had been made for the amalgamation of S.M.T., Ltd., a subsidiary of the S.M.T. bus combine, and the Midland & Scottish Air Ferries, Ltd. Air services were started by both companies this year. It is understood that S.M.T. have made an offer to acquire the Midland & Scottish Air Ferries, Ltd., and informal negotiations regarding the terms of sale have already taken place. The chairman of S.M.T., Ltd., is Lord Provost Thomson, of Edinburgh. Mr. John Sword is chairman of Midland & Scottish Air Ferries, Ltd. Both are directors of S.M.T., Ltd. Recently a conference was held between representatives of Midland & Scottish Air Ferries, Ltd., and Mr. Sean Lemass, Irish Free State Minister for Industry and Commerce. As a result of this conference it is learned that developments with regard to the services of the company to Dublin are contemplated in the near future. The route which particularly interests M. & S. is that from Cork to London, via Baldonnel and Hooton. Owing to the success of the Campbeltown, Islay and Belfast services of M. & S., it has been decided to reduce fares. The return fare to Belfast is now £3 10s., a reduction of 30s. The Islay fare has been cut by £1, making it now £3. The reduction in the fare for the round trip to Campbeltown is 10s., making the present cost £2 10s. Between Glasgow and Belfast there is a twice-daily service each way—at 9 a.m. and 3 p.m. Campbeltown is the intermediate stop. On Mondays, Tuesdays and Saturdays there are services to Islay, where a new landing ground, on the Machrie side of Bridgend, has been prepared.

KARACHI-MADRAS AIR SERVICE

AN interesting stage in the progress of Indian aviation is marked with the completion of one year's working of the Tata Karachi-Madras Air Service, which has been feeding the main artery of the Imperial Airways' system at Karachi and providing Western and Southern India with facilities for a through air post to Europe, South Africa and the Near East. The service has thus been well tested, and the principal fact to the credit of the organisation is that it has achieved "a hundred per cent. regularity." Since the launching of the enterprise it has not failed once. No mechanical breakdown has been recorded, and though the three light machines have had a strenuous experience, they are in perfect condition. During the year 107 trips have been made between Karachi and Madras, and the machines have flown a distance of 137,280 miles on regular flying, 11,580 miles on ferry flights and 6,525 miles on special flying for other purposes. Thus the total combined distance flown by the three "Moths" in one year amounts to 155,385 miles. The "ferry flights" had to be undertaken on those occasions when the Imperial Airways' mail aeroplanes happened to be late in arriving at Karachi. The speed attained on the 1,350-mile route during the past year's working is also commendable, and the maintained average is interesting in comparison with the speeds on the great trans-continental airlines. For instance, on the Imperial Airways' route from Croydon to Cape Town the average speed is 31 miles per hr., on the route between Croydon and Karachi the speed is 36 miles per hr., while the two foreign lines to the East—the French Air-Orient to Saigon and the Dutch K.L.M. to Batavia—each runs through its terminal at an average speed of 33 miles per hr. All these are far below the speed recorded on the Karachi-Madras route—52 miles per hr., including stops. The weight carried by the air mail has been steadily on the increase, having gone up 387 lb. 9 oz. Bombay is the largest user of the Tata air mail service, as the weight of air mails despatched from Bombay is approximately three-fourths of the total weight of the air mails carried by the aeroplanes. For further developing the usefulness of the services it is evident that facilities for

night flying are a basic requirement. Unlike the Indian Trans-Continental Air Service, the Tata Air Mail Service is not yet provided with an effective lighting and wireless system. Otherwise it appears that the minimum requirements of the service at present are two or three emergency landing grounds, between Karachi and Ahmedabad.

THE MOSCOW-VLADIVOSTOK SERVICE

IT is expected that on December 11 the 5,000-mile Moscow-Vladivostok mail service will be operated for the first time. Four and a-half days will be taken for the single trip, and the route will be covered three times monthly. Originally it was intended that the itinerary should pass through Manchuria, but for some unexplained reason it will be diverted towards Blagoveschensk and Khabarovsk.

THE FRENCH ROUTE TO SOUTH AMERICA

M. COT, Minister of Air, informed the Air Committee of the Chamber on November 22 that, owing to the expense of the scheme and the attitude of the Portuguese Government, it had been decided to relinquish the option acquired from the Portuguese Government on the use of the Azores as a stage on the South American air service. The project, he said, would have entailed an expenditure of £240,000. As one condition of the concession the Portuguese Government had insisted on the institution of services to all parts of its colonies.

The Hon. Rai Bahadur Lala Ram Saran Das, C.I.E., President of the Northern India Chamber of Commerce, who has been nominated by the Government of India as their representative on the Board of Indian Trans-Continental Airways, Ltd., the firm which is co-operating with Imperial Airways in running the air service between Karachi and Calcutta. *(Photo by courtesy of "Indian Aviation.")*

A LUFT HANSA "SPEED UP"

THE Deutsche Luft Hansa have placed the Junkers "G.38" aeroplane *Field Marshal von Hindenburg* on the Malmö-Copenhagen-Berlin service. The aeroplane is scheduled to fly from Berlin to Copenhagen in the astonishing time of 115 min. "G.38" is the largest landplane operated by the Deutsche Luft Hansa. It carries 32 passengers, has a buffet and is fitted with a special smoking compartment.

NEW BRAZILIAN ROUTE

THE Aerolloyd Iquassa S.A. is operating an air service four times weekly (Mondays, Wednesdays, Thursdays and Fridays) in both directions between Sao Paulo and Curityba. Single fare for the 292-mile journey is approximately £5 2s. 6d.

SIGNS OF THE TIMES

WE are pleased to note that this year, for the first time, the following services will be continued throughout the winter. Zurich-Geneva, Zurich-Berlin, Zurich-Vienna, Stuttgart-Geneva-Marseilles-Barcelona, and Geneva-Lyons-Paris-London. The use of Zurich airport will be made possible by the use of new equipment recently installed.

NEW AIR LINE IN KARELIA

A NEW air line between Petrozavodsk and Oblua, an important timber centre in one of the northernmost points in Karelia, has recently been opened. The new air line reduces the time taken to travel between the two places from days to two hours. Previously mail used to be brought a distance of 500 kilometres to Kem on the Mormansk railway and thence another 200 kilometres by road, which were impassable for long stretches of time in the winter. The new line will considerably speed up the mail services from the capital of Karelia to that point.

NEW AMPHIBIANS FOR PAN-AMERICAN AIRWAYS

AN order has been placed by Pan-American Airways with the Kreider-Reisner (Fairchild) Co. for six new amphibians at a cost of £46,715, with an option of six additional machines of similar type. These aircraft are to be cantilever monoplanes fitted with a single 700-h.p. radial engine mounted upon the wing and driving a tractor airscrew. Eight passengers and two pilots will be carried and a top speed of 180 m.p.h. is expected. This high speed is partly due to the fact that both land undercarriage and wing floats are retractable. The bottom of the hull is designed to allow emergency landings on rough ground. With 186 U.S. gallons of fuel it is expected that the range will be 750 miles. The new Sikorsky "Clipper" flying-boat for Pan-American Airways, which is being built in great secrecy, is expected to make its first test flights in a month or two.

THE CURTISS "CONDOR"

IT appears that the new type of Curtiss "Condor" is meeting with great success in America. Already nine have been bought by American Airways, nine by Eastern Air Transport, two by the U.S. Army, and one by Admiral Byrd. We now hear that ten new "Condors" have been ordered by American Airways. These will, we understand, be fitted with sleeping berths. Fitted with two geared Wright "Cyclones," the "Condor" has a top speed of 170 m.p.h. and cruises at 150 m.p.h.

SWISSAIR FOKKER FOR ABYSSINIA

A TRIPLE-ENGINED Fokker which was ordered by the Government of Abyssinia during the summer from Swissair will be flown by Walter Mittelholzer to Addis-Abeba early in December. It is hoped that some interesting aerial photographs will be secured during the trip.

SABENA STATISTICS

DURING October the fleet of Sabena aircraft covered 38,260 miles. Other figures which show a substantial increase over those of the corresponding period of last year are 179,295 passenger/miles of freight, and 575 ton/miles of mail.

SOUTH AFRICAN AIR POLICY

AN announcement was made recently by Mr. Pirow, Minister of Railways and Defence in South Africa, regarding the policy of the Government as regards civil aviation. The following quotation from his own words is interesting: "As far as our internal services are concerned, the Union Government has definitely decided that these internal services will be run either by the railways or in connection with the railways. That means that light aeroplane clubs and others will, in the nature of things, be confined to taxi work while passenger and goods traffic will be carried by the railways or in conjunction with the railways." He added that the light aeroplane clubs had for many years done valuable pioneer work, particularly in training pilots who had joined the reserve of the Defence Air Force, but for the present there was little hope of any direct subsidy for them. The State might, however, be prepared to consider helping gliding clubs.

AN IMPERIAL AIR LINE

AN East African correspondent of a contemporary writes that he has recently seen his first air liner. What struck him most was the entire lack of fuss, and the calm precision of its arrival. As the machine came to rest out stepped two officers, in uniform, with caps at just the right angle. They looked as spick-and-span as though they had merely travelled from Piccadilly to South Kensington. To exiles such detail is doubly welcome as a reminder of home and its nearness nowadays.

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

Edited by C. M. POULSEN

November 30, 1933

CONTENTS

SHOTWELDING

A Comparison with Riveting, based on test data

By JOHN C. ARROWSMITH,* M.Met., A.M.I.A.E.

THE improvements recently made in electric-resistance welding appear likely to bring about radical changes in the methods used for making joints in sheet-metal structures. For a long time riveting was the recognised practice, and, even after the spot-welding process had been developed to the point where it was accepted as an alternative, there remained certain objections to it which rendered it unacceptable to the aircraft industry.

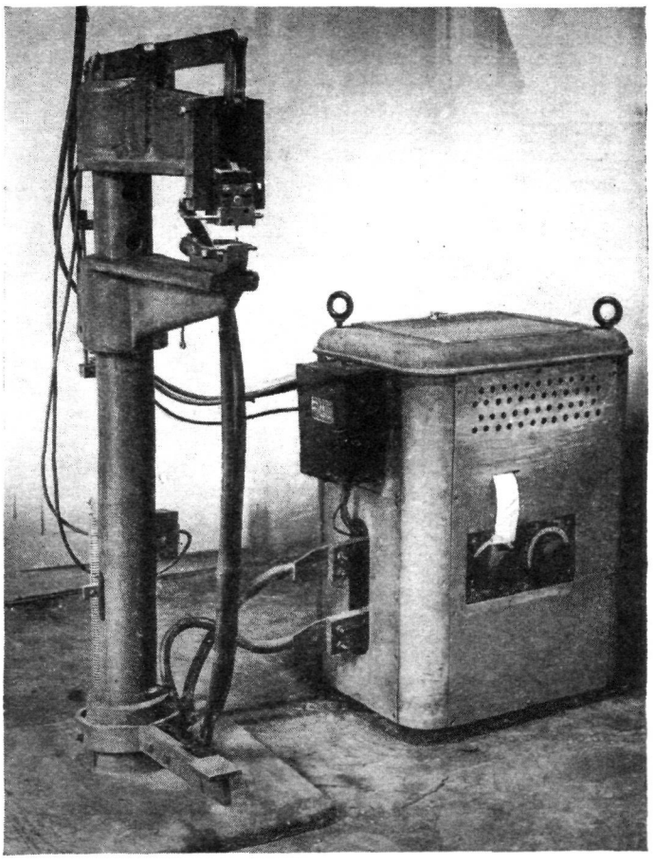
Experimental evidence showed that spot welds made on the ordinary commercial welding machines were liable to differ considerably in characteristics, and there was often a wide variation in the shear strength of welds made under what were apparently identical conditions. Some of the welds would be over-heated whilst others would show that the heat generated had been sufficient only to cause little more than a mere discoloration of the metal where the electrodes had made contact. This variation was itself serious enough, but the fact that cast still more suspicion on the process was that there is often practically no evidence from the visual inspection of the welds to indicate whether they were of satisfactory strength or not. On the other hand, rivets do provide a visibly positive bond between the two members of a joint.

Before spot welding could be considered up to the standard necessary for aircraft construction, it was necessary to produce a welding machine embodying the following essentials:—

(*a*) A device for controlling accurately the duration and magnitude of the current in the welding circuit; and

(*b*) Means whereby the quality of the welds produced might be indicated.

* Mr. Arrowsmith is Chief Metallurgist of the Pressed Steel Company of Great Britain.

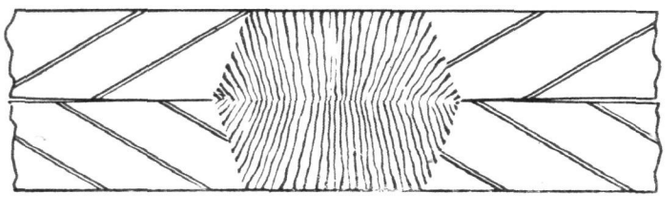


A SHOT-WELDING MACHINE : This photograph was taken at the Cowley works of the Pressed Steel Company. The paper strip of the autographic weld recorder may be seen emerging from its slot. (FLIGHT *Photo.*)

Both these features have been incorporated in the Budd shot-welding process, for which it is claimed that it has removed from spot-welding that lack of reliability which has until now impeded its development for aircraft work.

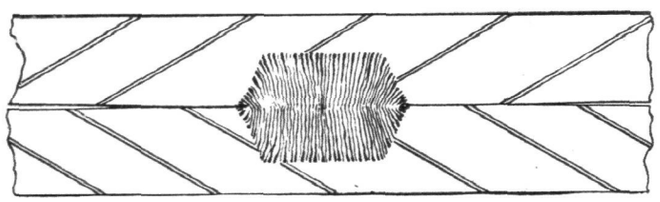
This machine was primarily designed to overcome the difficulties met with in welding stainless steel of the austenitic type. This material, having an electrical

resistance approximately seven times as high as that of ordinary low-carbon steel, calls for much shorter welding times if burnt welds are to be avoided. It was also considered advisable, in view of the danger of "weld decay" in this type of material, to employ the fastest possible weld in order to reduce to the minimum the time during which the material was in the danger zone, 600 deg. C. to 900 deg. C. Whilst the device for accurate control of current and time was of vital importance so far as austenitic stainless steel was concerned, it has incidentally been the means of ensuring uniformity in the welds made in many other types of material.



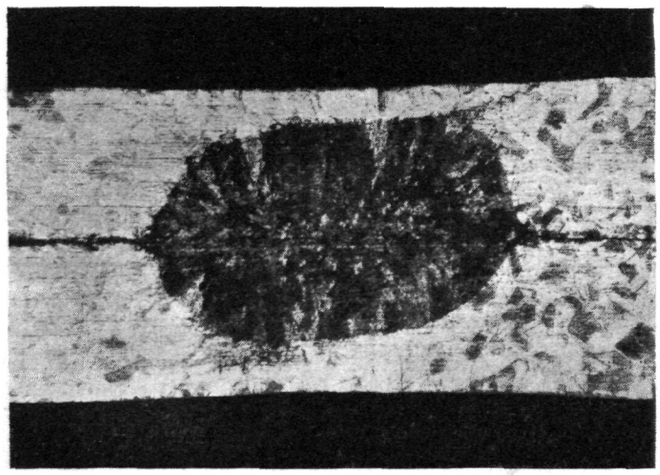
AN OVERHEATED WELD : In this the fused metal extends to the surface

There are certain materials for which the ordinary spot-welding process is not suited as a result of the physical properties possessed by these materials when very rapidly cooled from a temperature in the region of the melting point. For example, steels of the type containing 0.30 per cent. carbon, 3.0 per cent. nickel and 1.0 per cent. chromium become exceedingly hard and brittle on rapid cooling from high temperatures. As might be expected, spot welds in such material are too brittle to serve any useful purpose. No claims are made that the Budd shotwelder is suited to the welding of such materials.



A CORRECT WELD : This diagrammatic representation of a weld shows what approximate proportion of thickness should be occupied by the fused metal

The following test was made to illustrate the uniformity of welds made by the Budd shotwelder as compared with the results obtained by good riveting practice. Ten riveted test-pieces were made up by a firm engaged in aircraft construction. These test-pieces each consisted of two pieces of austenitic stainless steel (D.T.D. 166), $2\frac{3}{8}$ in. long by $\frac{3}{4}$ in. wide and 0.048 in. thick, which were overlapped and joined by one stainless steel rivet $\frac{1}{8}$ in. in diameter. These test-pieces were pulled in the tensile machine to obtain the breaking load. In every case the failure took place by shearing the shank of the rivet. The free ends of each test-piece were then overlapped and joined by a single shot weld using a standard Budd machine. The test-pieces were again pulled to fracture and in each case failure took place by shearing the weld. The breaking loads are given in Table A, from which will be seen that the shot welds show distinctly greater consistency in strength than the riveted joints.



SECTION THROUGH A SHOT WELD : This microphotograph shows how the slug or "shot" of fused metal is surrounded by a region of unaffected parent metal

TABLE A

Joint No.	Shear strength of rivets 0·125 in. diameter	Shear strength of weld 0·14 in. diameter
	lbs.	lbs.
1	980	1,100
2	885	1,110
3	885	1,130
4	875	1,170
5	905	1,155
6	880	1,185
7	945	1,145
8	865	1,070
9	845	1,100
10	955	1,175
Average	902	1,131
Highest value ...	Riveted joint 980 (8·65 per cent. above average)	Welded joint 1,185 (4·8 per cent. above average)
Lowest value ...	845 (6·32 per cent. below average)	1,080 (4·5 per cent. below average)

TABLE B

Joint No.	Shear strength of rivets 0·125 in. diameter	Shear strength of weld
	lbs.	lbs.
1	980	940
2	885	950
3	885	910
4	875	975
5	905	960
6	880	950
7	945	975
8	865	940
9	845	900
10	955	985
Average	902	954
Highest value ...	Riveted joint 980 (8·65 per cent. above average)	Welded joint 990 (3·77 per cent. above average)
Lowest value ...	845 (6·32 per cent. below average)	910 (4·61 per cent. below average)

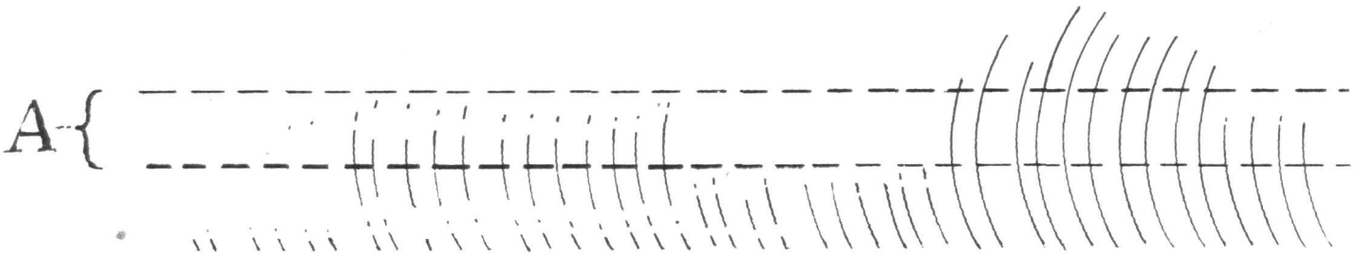
This series of uniform shot welds is by no means an isolated example. Testing by shearing of ten consecutive shot welds is one of the standard methods adopted by the manufacturers in demonstrating this type of welding machine; and in no instance has there ever been a greater variation than 10 per cent. from the mean value obtained. For comparison Table B, which shows a similar series of test on D.T.D. 60A (20 per cent. chromium, 2 per cent. nickel) is included.

Having arrived at a satisfactory state of affairs so far as uniformity of the individual weld is concerned, one may well consider the advantage offered by welding in the matter of strength. The strength of the riveted lap joint employing a single row of rivets is dependent upon the pitch of the rivets. By decreasing the distance between the rivets the joint may be strengthened up to a certain point only. Beyond this point the strength is reduced, as failure will occur by fracture of the material between the rivet holes. With spot welding, however, there is no weakening of the material resulting from the removal of material by drilling. The strength of the joint may thus be increased considerably by reducing the distance between the individual spots to a figure below the minimum permissible riveting pitch.

As is well known, the chief problem hitherto experienced in welding austenitic stainless steels has been the prevention of heating within the range 500°-900° C., which causes carbide precipitation with possible subsequent failure through corrosion. One advantage of shotwelding in this connection is that the extremely brief heating period can be so controlled that the zone of fusion is confined to the interior of the weld, a layer of material possessing a resistance to corrosion equal to that of the remainder of the sheet being left at the surface.

Tests have been made to demonstrate the effect of heating, and to compare welds made by ordinary spot-welding machines with those produced on the Budd shot-welder. The duration of the spot welds ranged from 0.1 to 3 sec., and the shotwelds were timed to considerably less than 0.1 sec. The pieces so welded were then subjected to a corrosion test, which consisted of immersing them for periods of 1 min. at 15-min. intervals in a 20 per cent. sodium-chloride solution.

The results showed that where the welding time exceeded 0.1 sec., rusting commenced very quickly, but on the faster welds signs of corrosion appeared only after several weeks' test; moreover, this corrosion was easily removed by wiping with a damp cloth. A further



AUTOGRAPHIC STRIP FROM THE WELD RECORDER. The limiting range for good welds is enclosed by the area "A." After the preliminary run on the left follows a run of good welds. Then a number of under-heated welds, and on the right a run of overheated welds. It should be pointed out that this strip was prepared to show how the quality of welds is indicated. The machine does not, of course, normally behave in such erratic fashion

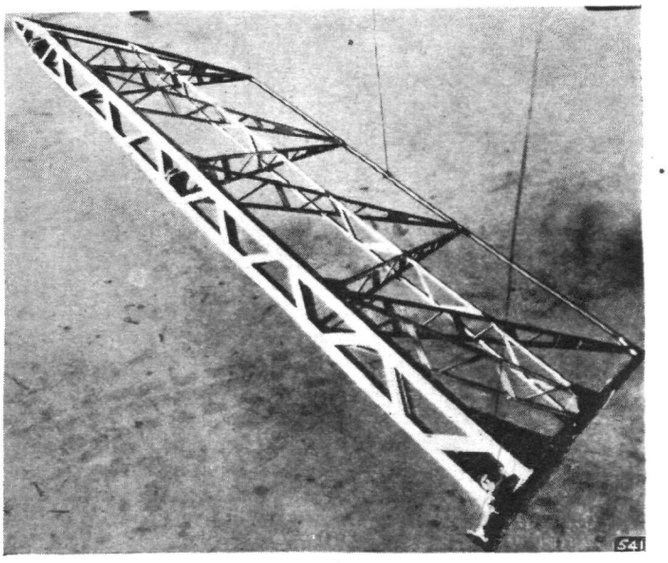
Tests have been carried out to demonstrate this point using 0.031-in. sheet steel to D.T.D. Specification No. 166. The material was cut into strips 3 in. long and $1\frac{1}{2}$ in. wide, the edges being ground to remove the effect of shearing. Four riveted samples were made up, each consisting of two of the above pieces overlapped along the $1\frac{1}{2}$-in. edge. Austenitic stainless-steel rivets, $\frac{1}{8}$ in. diameter, were used, and the pitches used for the different samples were $\frac{1}{2}$ in., $\frac{3}{8}$ in., $\frac{9}{64}$ in., and $\frac{1}{4}$ in. respectively. On pulling the test-pieces to fracture in the tensile-testing machine, it was found that 4,300 lb. was the highest strength obtained, and this was the piece employing the $\frac{3}{8}$-in. pitch. With the smaller pitches the metal failed between the rivet holes. Similar shot-welded samples were prepared in which the number and pitch of the welds was varied from four welds with a pitch of $\frac{3}{8}$ in. to 10 welds with a pitch of $\frac{5}{32}$ in. The maximum strength was obtained from the test-piece with eight welds and a pitch of $\frac{3}{16}$ in., which broke at 5,825 lb.

It is interesting to observe that no advantage was gained by decreasing the pitch beyond $\frac{3}{16}$ in. The fracture in the case of the test-pieces with 8, 9, and 10 welds was in the metal immediately adjacent to the welds. This is accounted for by the fact that the steel used for the tests has its high ultimate strength developed in it by cold working. The heat of welding removes this cold work, and the physical properties of the material in the welds are those of the steel in the fully softened state.

The ultimate strength of one of the 3-in. by $1\frac{1}{2}$-in. strips used in the experiment was 7,250 lb. This strength could not be developed in either the riveted or the shot-welded joint, but the latter was distinctly the stronger of the two.

experiment in which the welds were treated with metal polish before testing for corrosion, was made, and it was found that even the slight tendency towards corrosion hitherto noted was eliminated.

As a further investigation into the effects of heating time on weld characteristics, some strength tests were made, "Twoscore" steel (D.T.D.60A) being used for this purpose, 0.032 in. thick × 2 in. long × $\frac{3}{4}$ in. wide. A weld with an extremely brief timing was made and pulled; it gave a strength of 550 lb. The timing period was then increased by 0.02 sec., and it was found that



ASSEMBLED BY SHOT WELDING : An aeroplane elevator

the strength increased to 720 lb. With a welding period 0.03 sec. greater, the shear strength rose to 910 lb. For measuring the extremely brief timings used in shot-welding, a cathode-ray oscillograph is employed, and photographic records are made. The large number of experiments made shows that there is a definite relation between welding time and strength.

It is interesting to turn from the laboratory aspects of shotwelding to the practical advantages it has to offer to the constructor. It is worth noting that the increased strength gained from increasing the number of shotwelds can be obtained with practically no extra cost. This compares favourably with riveting, in which each additional rivet represents a definite expense.

Another great advantage is the ease with which fabrication problems may be overcome, and difficult sections assembled. Sound riveting depends upon the provision of proper support to the back of the rivet during the closing-down operations, and it is common knowledge that this support is difficult to arrange; designs have, in fact, often to be modified on account of the impracticability of riveting. In such difficult positions, shot-welding can be successfully employed since an indirect method can be used. One lead from the secondary of the welding-machine transformer is attached to a part of the structure close to the point where the weld is to be made, and the other lead is connected to a single spring-loaded electrode. When contact is made with this electrode on the outside of the structure and sufficient pressure applied to overcome the spring pressure, a weld is produced. For ordinary work on 20-gauge sheet steel, the normal electrode pressure is round about 75 lb., which is obtained either by compressed-air tools or hand-operated pincers, which can be readily worked up from soft copper to suit individual requirements. The working tips of the electrodes are made of a special wear-resisting copper-tungsten alloy, which is brazed into the copper base.

Both theoretically and practically, therefore, shot-welding seems to have much to offer to the aircraft constructor, and demands very close investigation.

THE DESIGN OF AEROFOILS AND THE PREDICTION OF CHARACTERISTICS

By W. R. ANDREWS, A.F.R.Ae.S.

(*Continued from page* 71.)

THE profile shape is completely defined when the leading-edge radius is fixed. The N.A.C.A. use a radius of leading edge which follows the law.

$$R = 1.095\ t^2 \quad \ldots\ldots\ldots\ldots\ (6)$$

Where R and t are in terms of the chord.

This may need modification to suit individual requirements, but in general should give satisfaction. Where, for instance, a wing is tapered in plan (unless the wing is of wooden construction) the radius of the leading-edge tube will probably be constant, and the above relationship will only hold at one point.

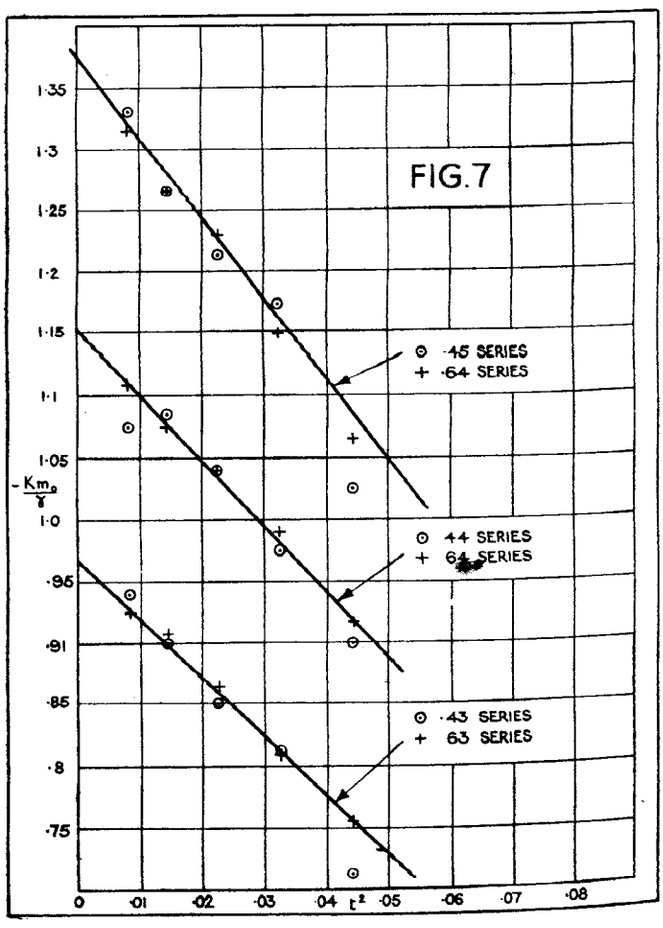
The importance, or otherwise, of the leading-edge radius is not indicated by the test results. It is not anticipated, however, that fairly large variations would cause serious changes in the drag. It is possible that the "Aerodynamic" nose is slightly affected by the leading-edge radius, so that by using the radius given by (6) any possible variation due to this cause is avoided, since this radius was used on the aerofoils upon which this analysis is based.

The estimation of no-lift characteristics has been dealt with in a previous article (Ref. 7), but the data used were from the low-pressure wind-tunnel tests. The R. & M. 910 definition of centreline was used in that article, and it had been hoped to express the results of the V.D. Tunnel test in terms of that same centreline.

The amount of work in analysing the present series of aerofoils in terms of the R. & M. 910 definition of centreline was prohibitive, and the results obtained were not too encouraging: (After several attempts it was finally abandoned in favour of the N.A.C.A. centreline.) To facilitate reference, a summary of the principal characteristics has been made for the four series of aerofoils at present under review. This is given in Table 2.

TABLE 2.—SUMMARY OF CHARACTERISTICS

Section	α_0	Km_0	$dK_L/d\alpha$	$\frac{dKm}{dK_L}$	$K_L$opt.	$K_L$max.
0006			0·0513	−0·242	0	0·4335
09			0·0503	−0·243	0	0·5975
12			0·0504	−0·238	0	0·7065
15			0·0486	−0·236	0	0·706
18			0·0481	−0·233	0	0·7145
21			0·0445	−0·229	0	0·638
4306	−3·79	−0·0375	0·0513	−0·247		0·60
09	−3·54	−0·0375	0·0505	−0·245		0·80
12	−3·60	−0·036	0·0505	−0·248	$0·28-\frac{4t}{3}$	0·815
15	−3·58	−0·034	0·0495	−0·245		0·78
18	−3·44	−0·0325	0·0488	−0·241		0·73
21	−3·55	−0·0285	0·0460	−0·234		0·645
6306	−4·82		0·0507	−0·249		0·77
09	−5·35	−0·0555	0·0513	−0·249		0·83
12	−5·35	−0·0545	0·0498	−0·246		0·82
15	−5·3	−0·052	0·0494	−0·244	$0·47-2t$	0·775
18	−5·18	−0·0485	0·0480	−0·240		0·715
21	−5·2	−0·0455	0·0461	−0·236		0·685
4406		−0·0435		−0·248	0·21	0·615
09	−3·6	−0·043	0·0501	−0·248	0·18	0·80
12	−3·8	−0·0435	0·0498	−0·245	0·15	0·805
15	−3·8	−0·0415	0·0490	−0·240	0·115	0·785
18	−3·7	−0·039	0·0474	−0·236	0·085	0·735
21	−3·5	−0·036	0·0452	−0·235	0·055	0·685
6406				−0·25	0·31	0·715
09	−5·95	−0·0665	0·0499	−0·25	0·265	0·84
12	−5·75	−0·0645	0·0493	−0·244	0·22	0·825
15	−5·75	−0·0625	0·0476	−0·241	0·17	0·795
18	−5·75	−0·0595	0·0462	−0·237	0·125	0·755
21	−5·3	−0·055	0·0451	−0·232	0·08	0·705
4506	−4·32	−0·0535	0·0500	−0·246	0·2	0·58
09	−4·13	−0·0535	0·0495	−0·246	0·165	0·78
12	−4·03	−0·0505	0·0492	−0·242	0·13	0·84
15	−4·07	−0·0485	0·0479	−0·242	0·095	0·81
18	−3·85	−0·047	0·0471	−0·237	0·06	0·77
21	−3·4	−0·041	0·0460	−0·227	0·025	0·73
6506	−6·35		0·0484	−0·249	0·32	0·645
09	−6·35	−0·079	0·0483	−0·248	0·265	0·855
12	−6·27	−0·076	0·0478	−0·245	0·21	0·875
15	−5·91	−0·074	0·0456	−0·238	0·155	0·835
18	−5·7	−0·069	0·0454	−0·235	0·10	0·805
21	−5·23	−0·064	0·0443	−0·233	0·045	0·745



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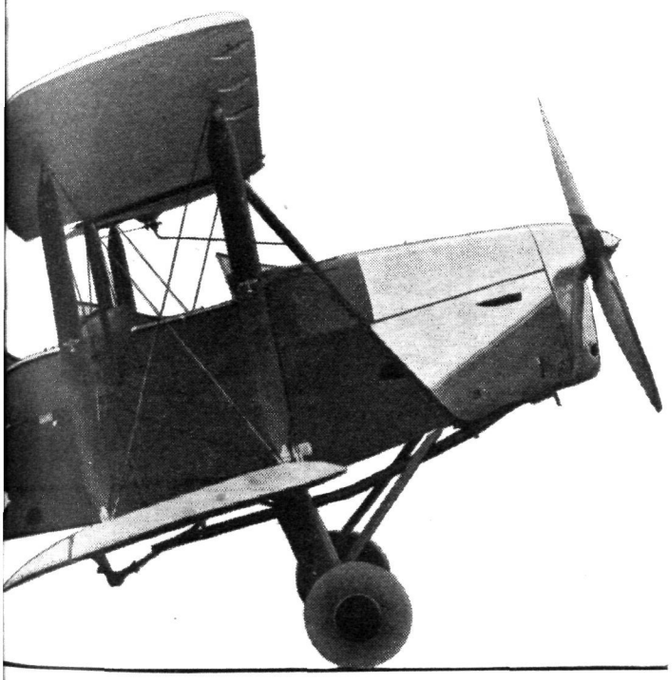

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One of the most important relationships brought out by these tests is the proportionality of Km_0 to the camber ratio. This is as suggested by the theory of thin aerofoils, and although the value of the moment falls below the calculated value for any thickness ratio, the ratio of calculated to observed remains the same for any camber at constant thickness ratio.

For any camber ratio the Km_0 falls off as a function of the square of the thickness ratio as shown by Fig. 7, where $\frac{Km_0}{\gamma}$ is plotted against t^2.

Where γ = Maximum camber of centreline.
t = Maximum thickness-to-chord ratio.

Table 3 gives the laws for the mean curves drawn through the points for the three series.

TABLE 3

Series	Observed Km_0
43—63	$-0{\cdot}967\ (1-4{\cdot}9\ t^2)\ \gamma$
44—64	$-1{\cdot}15\ \ (1-4{\cdot}9\ t^2)\ \gamma$
45—65	$-1{\cdot}375\ (1-4{\cdot}9\ t^2)\ \gamma$

The physical significance of the function $(1\text{-}4.9\ t^2)$ is a little obscure, but its recurrence greatly assists the investigations. It is now only necessary to compare the extrapolated value of Km_0 for $t = o$ with the value calculated for the centreline by means of R. & M. 910.

Since it has been shown that both the observed and the calculated Km_0 are proportional to camber, we may compile Table 4, giving the relationships between Km_0 and camber for the cambered sections.

TABLE 4

Series	Calculated Km_0	ΔKm_0 (calculated-observed)
43—63	$-1{\cdot}12\ \gamma$	$-0{\cdot}153\ \gamma$
44—64	$-1{\cdot}319\ \gamma$	$-0{\cdot}169\ \gamma$
45—65	$-1{\cdot}57\ \gamma$	$-0{\cdot}195\ \gamma$

An empirical correction to the calculated value of Km_0 was suggested in a previous article (Ref. 7) based on the camber ratio of the section. This correction only applied to non-reflexed sections which, if the sections have somewhat similar shapes of centreline, may be considered as being expressed in terms of the trailing edge slope.

Table 5 and Fig. 8 give the results of expressing this difference between calculated and observed Km_0 in terms of the trailing-edge slope (ψ) for the R.A.F. Series of Aerofoils, tested at low value of Reynolds Number.

TABLE 5

Aerofoil	ψ = T.E. slope of Centreline	Km_0 Observed	Km_0 Calc. by R. & M.910	ΔKm_0
R.A.F. 25 ...	−0·041	−0·016	−0·016	0
26 ...	−0·082	−0·028	−0·031	0·003
28 ...	−0·05	−0·022	−0·022	0
31 ...	−0·082	−0·029	−0·032	0·003
32 ...	−0·202	−0·067	−0·078	0·011
33 ...	+0·0516	−0·009	0	−0·009
34 ...	+0·0207	−0·005	0	−0·005

These low-pressure tunnel tests give a linear variation of $\triangle Km_0$ with trailing-edge slope. Warner suggests (Ref. 8) an approximate relationship between trailing-edge slope and Km_0, which will be shown later as only possible when the shapes of the aerofoils are similar and the thickness ratios the same.

With the V.D. tunnel tests the effect of trailing-edge slope can be separated from that due to the slope of the leading edge in the following manner:—

Since Km_0 is proportional to camber, it is possible to forecast Km_0 for any camber of any of the series from the known value of Km_0 at another camber. If, therefore, we choose one particular camber for one series and adjust the camber of the other series to give the same trailing-edge angle, then by the aid of Table 4 we can compile Table 6, which gives Km_0 for a constant trailing-edge slope of −0.16.

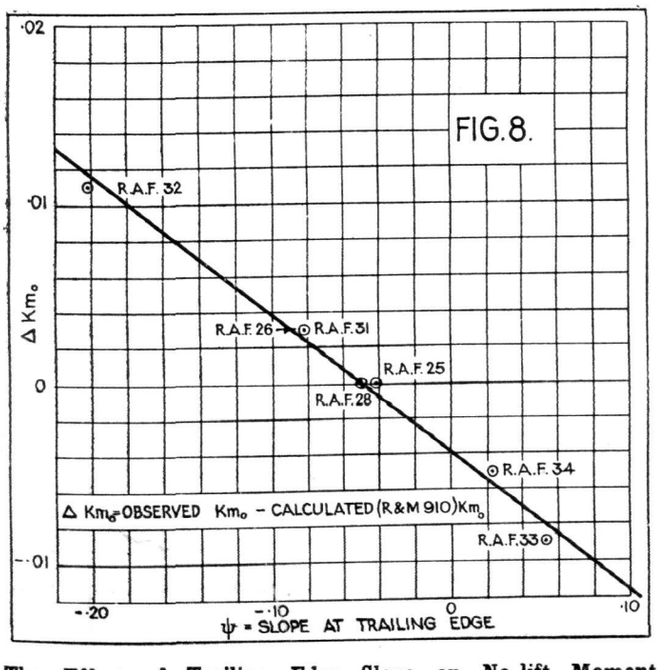
TABLE 6

Series	T.E. Slope = ψ	γ to give ψ = −0·16	L.E. Slope ϕ	ΔKm_0 (ψ = −0·16)
43—63	$-\gamma \div 0{\cdot}3$	0·056	$\gamma \div 0{\cdot}15 = 0{\cdot}373$	0·0086
44—64	$-149\ \gamma - 49$	0·048	$\gamma \div 0{\cdot}2 = 0{\cdot}24$	0·0081
45—65	$-\gamma \div 0{\cdot}25$	0·040	$\gamma = 0{\cdot}25 = 0{\cdot}16$	0·0078

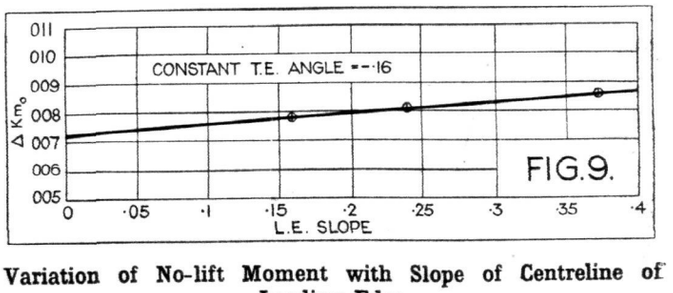
The values of $\triangle Km_0$ refer to the extrapolated values when $t = o$.

Fig. 9 gives the plot of these interesting results, the law to the curve drawn being

$$\Delta Km_0 = +0{\cdot}00725 - 0{\cdot}0036\ \phi \text{ [for } \psi = -0{\cdot}16 \text{ and } t = o] \quad (7)$$



The Effect of Trailing Edge Slope on No-lift Moment Correction. Low-pressure Wind Tunnel Tests



Variation of No-lift Moment with Slope of Centreline of Leading Edge

The process can now be reversed by keeping the leading-edge slope constant, as given by Table 7 and Fig. 10, the leading-edge slope being 0.264.

TABLE 7

Series	L.E. Slope ϕ	γ to give $\phi = 0{\cdot}264$	T.E. Slope ψ	ΔKm_0 ($\phi = 0{\cdot}264$)
43—63	$\gamma \div 0{\cdot}15$	0·04	$-\gamma \div 0{\cdot}3 = -0{\cdot}114$	0·0061
44—64	$\gamma \div 0{\cdot}2$	0·0533	$\frac{-149\gamma}{49} = -0{\cdot}178$	0·009
45—65	$\gamma \div 0{\cdot}25$	0·066	$-\gamma \div 25 = -0{\cdot}264$	0·0129

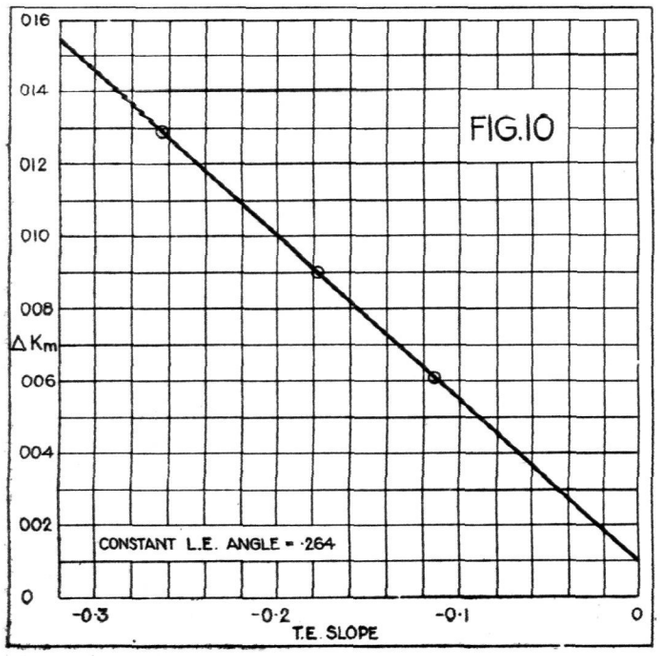
The law to the curve is

$\Delta Km_0 = 0{\cdot}0009 - 0{\cdot}0453\ \psi$ [for $\phi = 0{\cdot}264$ and $t = o$... (8)

The final combination gives (from Table 3 and equations 7 and 8) :—

$Km_0 = F_t\,[Km_0$ (calc. by R. & M. 910) $+ 0{\cdot}0036\ \phi - 0{\cdot}0453\psi]$..... (9)

where $F_t = [1 - 4{\cdot}9\ t^2]$



Variation of No-lift Moment with Slope of Centreline of Trailing Edge

This result is obtained from either Figs. 9 or 10, but both have been included to show more clearly the relative effect of leading- and trailing-edge slopes. The plotted values in Fig. 9 show that there is very little change in Km_0 with the leading-edge angle. This confirms Warner's conclusion that to a first approximation the Km_0 is a function of the trailing-edge angle only.

For any particular shape of centreline the trailing-edge angle is proportional to camber. It has been shown also that Km_0 is proportional to camber for sections similar to those at present under discussion. For sections, it follows, therefore, that Km_0 is proportional to trailing-edge angle.

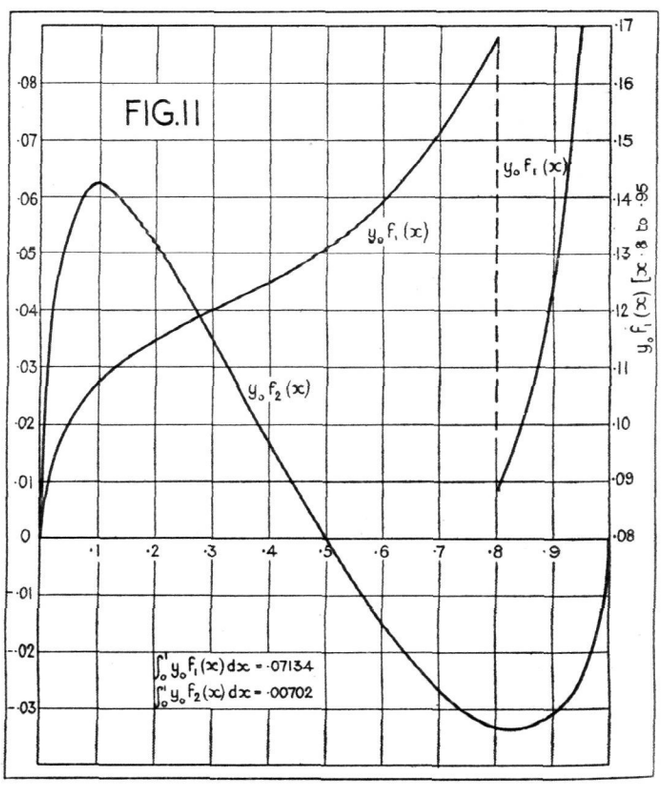
If, now, one considers a reflexed section having $Km_0 = 0$ then Km_0 is zero for all values of trailing-edge angle. Again, in the case of the centreline which becomes tangential to the datum line at the trailing edge, the trailing-edge angle is always zero, while Km_0 is finite and still proportional to camber. Between these two cases there are an infinite number of combinations which make it impossible to represent Km_0 wholly in terms of trailing-edge angle. Any such curve can only apply to one shape of aerofoil.

Warner's curve, while forming an excellent guide to the moment of similar aerofoils, must be used with discretion when attempting to apply it to special cases.

For the present series it is found that the approximation for Km_0, in terms of the trailing-edge angle, takes the form :—

$Km_0 = 0{\cdot}34\ \psi\ (1 - 4{\cdot}9\ t^2)$ ..... (10)

The obvious check on the empirical correction of equation (9) would be to apply it to a reflexed section where the trailing-edge angle is of opposite signs. Choosing at random sections Nos. N.60 and N.60.R.

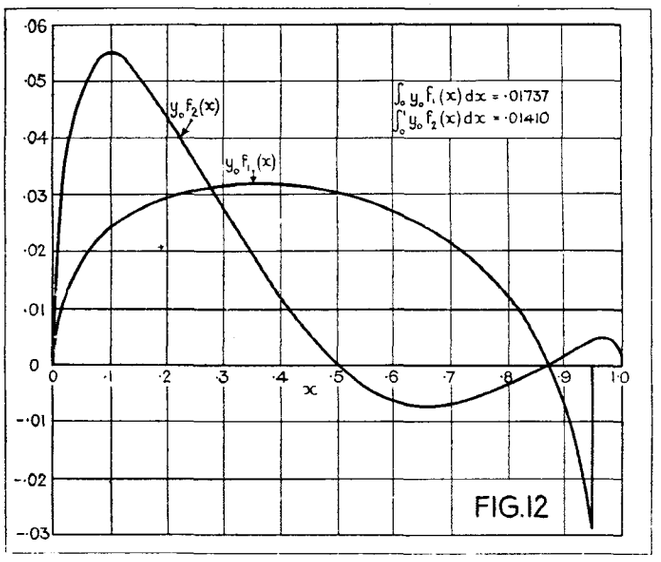


Section N. 60. Calculation of No-lift Characteristics by Method of R. and M. 910

TABLE 8

Section			N.60			N.60 R.		
x	$f_1(x)$	$f_2(x)$	y_0	$y_0 f_1(x)$	$y_0 f_2(x)$	y_0	$y_0 f_1(x)$	$y_0 f_2(x)$
0						0		
0·0125	2·89	8·78	0·0035	0·0101	0·0308	0·0031	0·0090	0·027
0·025	2·09	6·10	0·0071	0·0148	0·0432	0·0063	0·0132	0·0385
0·05	1·54	4·13	0·0130	0·0200	0·0537	0·0116	0·0179	0·0480
0·075	1·31	3·225	0·0187	0·0245	0·0603	0·0166	0·0217	0·0535
0·1	1·18	2·67	0·0234	0·0276	0·0625	0·0206	0·0243	0·0550
0·15	1·05	1·96	0·0299	0·0314	0·0585	0·0257	0·027	0·0503
0·2	1·0	1·5	0·0348	0·0348	0·0522	0·0292	0·0292	0·0437
0·3	0·99	0·87	0·0402	0·0398	0·0350	0·0318	0·0315	0·0277
0·4	1·08	0·41	0·0411	0·0443	0·0168	0·0294	0·0317	0·0120
0·5	1·27	0	0·0410	0·0521	0	0·0245	0·0312	0
0·6	1·62	−0·41	0·0364	0·0590	−0·0149	0·0166	0·0269	−0·0068
0·7	2·31	−0·87	0·0308	0·0712	−0·0268	0·0077	0·0178	−0·0067
0·8	3·98	−1·50	0·0222	0·0883	−0·0333	0·0025	0·0097	−0·00375
0·9	10·6	−2·67	0·0113	0·1230	−0·0310	−0·0005	−0·0064	+0·0016
0·95	29·2	−4·13	0·0058	0·1695	−0·0240	−0·0010	−0·0292	+0·0041
1·0	α		0			0		
$\frac{dy}{dx}$	ϕ			+0·279			+0·251	
	ψ			−0·115			+0·0368	

(Ref. 9), where N.60.R. is a reflexed section obtained by reflexing the rear portion of N.60, the sections have been plotted out on squared paper to obtain the centre-line by the N.A.C.A. definition. The resulting centre-line to datum and the calculation of the no-lift characteristics are given in Table 8 and Figs. 11 and 12.



Section N. 60 R. Calculation of No-lift Characteristics by Method of R. and M. 910

The summary of the calculated values of R. & M. 910 functions are given in Table 9.

TABLE 9

Section	t	L.E. Slope $= \phi$	T.E. Slope $= \psi$	$F_1 = \int_0^1 y_0 f_1(x)dx$	$F_2 = \int_0^1 y_0 f_2(x)dx$
N.60 ..	0·1245	+0·279	−0·115	0·07134	0·00702
N.60 R	0·1245	+0·251	+0·0368	0·01737	0·0141

Taking first N.60 section and applying the empirical correction of equation (9)

$$Km_0 = \left[1 - 4{\cdot}9 \times 0{\cdot}1245^2\right]\left[\left(-\frac{\pi}{4} \times 0{\cdot}07134 + 0{\cdot}00702\right) + 0{\cdot}0036 \times 0{\cdot}279 + 0{\cdot}0453 \times 0{\cdot}115\right]$$
$$= 0{\cdot}924\,(-0{\cdot}05604 + 0{\cdot}00702 + 0{\cdot}00101 + 0{\cdot}00521)$$
$$= 0{\cdot}924 \times (-0{\cdot}0428).$$
$$= -0{\cdot}03955$$

The measured value for Km_0 was $-0{\cdot}04$ so that the agreement here is good.

Similarly, for Section No. N.60 R.

$$Km_0 = 0{\cdot}924\left(-\frac{\pi}{4} \times 0{\cdot}01737 + 0{\cdot}0141 + 0{\cdot}0036 \times 0{\cdot}251 - 0{\cdot}0453 \times 0{\cdot}0368\right)$$
$$= 0{\cdot}924\,(-0{\cdot}01363 + 0{\cdot}0141 + 0{\cdot}00090 - 0{\cdot}00167)$$
$$= -0{\cdot}924 \times 0{\cdot}0003 = -0{\cdot}00028$$

The measured Km_0 was -0.0005, so that the accuracy of the empirical correction is about the same for reflexed as for non-reflexed sections.

The suggested empirical correction to the calculated moment at no-lift gives results which are in keeping with the measured moment at high Reynolds Number, for both reflexed and non-reflexed sections. Further checks may be necessary as more information becomes available, but for all practical purposes it is thought the correction will be sufficiently accurate.

REFERENCES

7 "No-lift Characteristics." W. R. Andrews. AIRCRAFT ENGINEER, Dec. 27, 1929.
8 Aviation Handbook. E. P. Warner and S. P. Johnson.
9 N.A.C.A. Technical Note No. 388. "Wind Tunnel Comparison of Three Normal and Three Reflexed Aerofoils." G. L. Defoe.

(To be continued.)

TECHNICAL LITERATURE

"THE STRESSES IN AEROPLANE STRUCTURES"*

THERE are three more or less independent methods of improving the efficiency of our aeroplane structures, and these may be classified as the engineering way, the scientific way and the mathematical way. The engineer's task is to build lighter and even lighter structural members to carry loads of a given magnitude. The scientists should contribute more exact knowledge of the types and magnitude of the loads imposed by various conditions of flight and landing—and this they do, but unfortunately it is very rarely that they advocate any reduction in load and factor requirements. Lastly, the mathematicians can help by devising more correct methods of calculating first the distribution of the loads throughout the structure and second the effect of such loads on the individual members of the structure. Here again it is unfortunate that more correct methods usually involve more complex calculations.

It is most refreshing, therefore, to be able to pay tribute to Mr. H. B. Howard as the originator of the most important simplification in stressing methods which has been introduced since the late Arthur Berry tabulated his famous functions. The method of utilising polar diagrams for determining the stresses in beams under compression was first described by Mr. Howard in R. & M., 1233, and is now more amply described in the book under review.

The avowed object of this book is to collect together "those portions of the theory of structures which are of particular interest to the aeroplane designer"—and this object has been well and truly achieved. It is, however, definitely the mathematical side of the subject that is under consideration, and readers must not expect to find guidance on how to proportion their aeroplane structures or to find any but slight information on the aerodynamic loads imposed on the structure. These omissions are not defects, but the natural outcome of a considered policy which is in itself a striking comment on the development of the science of strength calculations. Mr. Howard's book will be an essential part of the equipment of all those engineers whose task it is to deal with the mathematical side of aeroplane structural design. By reducing many complicated problems to comparatively simple formulæ, the author has laid a debt of obligation on the shoulders of those general practitioners of stress-work who do not wish either to puzzle such matters out for themselves or, in the more advanced problems, to browse among the pastures of Phil. Trans. Roy. Soc.

Chapters I and II deal with the elementary subjects of "Stress and Strain" and "Bending of Beams." Chapters III and V cover the cases of uniform and tapered struts very completely—but naturally do not include curves of strength of actual tubes. Chapters IV and VI deal with both analytical and graphical methods for stressing single-bay and continuous beams. In addition to many applications of the polar diagrams already mentioned, we have an account of those improvements in the Berry analytical method which have been devised by either Mr. Howard himself or his colleagues at Farnborough.

Chapter VII summarises the standard elementary work on simply stiff frameworks and introduces the Southwell tension coefficients, whose virtues cannot be too often impressed on any who are not yet familiar with them. Chapter VIII on Strain Energy is very important in these days when all redundancies of structure may be taken into account in calculations. The sections on the bow strain of struts and on the application of strain energy to members which do not obey Hooke's law are both unusual and important. They suggest the possibility of approximating more closely

* "The Stresses in Aeroplane Structures," by H. B. Howard, B.A., B.Sc., F.R.Ae.S. Published by Sir Isaac Pitman and Sons, Ltd. Obtainable from FLIGHT Offices, price 20s. 9d., post free.

by calculation to the real behaviour of structures under their failing loads, though such work would be a matter of research rather than routine.

Chapters IX and X on Torsion and Thin Walled Sections contain many useful formulæ, but Chapter X could usefully be expanded in a second edition, especially as the results of researches now proceeding on monocoque construction should be available by that time.

Chapters XI, XII and XIII bear the titles "The Loads upon an Aeroplane," "The Main Plane Structure," and "Tail Unit—Fuselage—Undercarriage." They only occupy 14 pages between them and even Mr. Howard can hardly do justice to such titles in so small a space, though the material given is well selected.

The three Appendices cover properties of plane sections, notation and Berry functions. The notation definitions include the dimensions in terms of force and length of all quantities—an important point as checking the dimensions of formulæ and equations is a powerful antidote to error.

The book is carefully thought out and well produced with excellent diagrams. There appear to be very few mistakes on the part of either author or compositor. On page 30 there is some risk of confusion between mean shear stress across the breadth of a beam as given in equation (26)—not (27) as printed—and mean shear stress across the depth as shown in Fig. (27). Also it would be desirable to have a more distinctive symbol for the Greek alpha.

The very few criticisms which have been made are small matters indeed, and Mr. Howard is to be congratulated on producing a book which will be a most valuable standard work on his chosen subject.

H. A. M.

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any Bookseller.

A SIMPLIFIED PRESENTATION OF THE SUBJECT OF THE SPINNING OF AEROPLANES. By H. B. Irving, B.Sc. R. & M. No. 1535. (32 pages and 10 diagrams.) March 27th, 1933. Price 1s. 9d. net.

In this report a broad view of the subject is taken, the argument being kept as short as possible, and some sacrifice in rigidity being made in the interest of clarity.

The report is not concerned with either the prevention of the involuntary spin, to which so much attention has been, and is still being, directed, or the problem of recovering from such an undeveloped spin; but exclusively to the problem of preventing such a spin from developing into a flat spin.

The aerodynamic characteristic which makes it possible for an aeroplane to spin is essentially the same as that which gives rise to the well-known phenomenon of "auto-rotation," namely, the automatic rolling motion which may occur owing to the fall of the lift beyond the stall. Auto-rotation, however, as commonly understood, refers to the behaviour of a model mounted symmetrically so that it is free to rotate about the axis parallel to the wind direction through its centre of gravity. The term may conveniently be extended to include the rotary motion which may be possible when the model is free to rotate at a radius and also in unsymmetrical attitudes: that is, rotary motion combined with sideslip.

Using auto-rotation in this wider sense we do not know of any arrangement of fixed wings which will not, with an appropriate amount of sideslip, auto-rotate rapidly at any incidence between say 30° and 80°.

Existing experimental information therefore indicates that the prevention of the rapid flat spin is to be sought not in the use of wings which cannot auto-rotate at high rates, but in measures which will ensure that the wings cannot remain in those attitudes in which rapid auto-rotation is possible. Such measures are the provision of sufficient effective fin and rudder area, or its equivalent in depth of body near the tail; and it is the main conclusion of the report that the flat spin can generally be eliminated in this way without going to an impracticably large fin and rudder. There are, however, a variety of other characteristics which may be either favourable or unfavourable to the flat spin, and when, for any reason, it is not convenient to provide sufficient fin effect to over-ride these influences they may turn the scale from safety to danger.

The most important of these secondary factors is the relative distribution of weight along wings and body, which may give rise to a yawing inertia couple of some magnitude. The way in which this couple is caused by the centrifugal forces acting on the various parts of the aeroplane is simply explained. The sense in which the couple acts in a spin, however, depends not only on the weight distribution but also on the auto-rotational properties of the wings; the explanation in detail of its interaction with these properties is somewhat complex and is given in an Appendix. The important point to observe, however, is that the yawing inertia couple may be either helpful or harmful according to the type of design; that is, according to the wing arrangement and the way in which the masses are distributed. For example in a monoplane or highly staggered biplane (which are broadly similar in aerodynamic characteristics), if the big weights are in the body the yawing inertia couple will usually be harmful, while if the weights are in the wings it will be helpful. For an unstaggered biplane, on the other hand, to have the big weights in the body is preferable to having them on the wings so far as spinning is concerned. Again, if the stagger is moderate the weight distribution will probably matter little.

The report aims at giving the designer some idea as to whether any particular aerodynamic-inertia combination is favourable or unfavourable, and to what extent. An indication is given as to the effective fin area required when the mass distribution and/or wing arrangement are such that the yawing inertia couple is of little account, and also as to the extent to which this should be increased in the worst case which is likely to arise.

It would appear that even when catering for the worst case the effective fin area called for is not so large as to interfere with the general design of the aeroplane, particularly if a fair proportion of the total fin area can be provided by the body. Should there be no objection to a body of fair depth at the rear, the amount of effective fin required apart from the body is then quite moderate; while should for some reason or other, a specially thin or circular body be desired, it is still possible in the worst case to attain safety without unusually large surfaces if a practicable design can be devised in which the fin and rudder are unshielded by the tailplane under spinning conditions.

If both the mass distribution and the wing arrangement are regarded as being outside the disposal of the designer it remains broadly true that only by providing adequate effective vertical fin area can safety be attained. But if either the mass distribution or the wing arrangement, or both, are regarded as at his disposal, he may be able to reduce materially the fin area required.

Other characteristics such as slots, fin area forward of the position of the centre of gravity, dihedral and sweep back of the wings, &c., also affect the problem to a more or less minor extent and their influence so far as it is known at present are discussed in the report and Appendices. The effect of slots on spinning is a question now receiving considerable attention. It would appear from the work done so far that so long as the spin does not tend to be flat slots are generally, but not invariably, favourable in their effect; but should the spin become flat (incidence 60° or more) their effect may be adverse and of quite serious magnitude.

Summing up the various conclusions arrived at there is one outstanding conclusion, which is as follows:—

(1) By far the most effective means of ensuring safety in spinning is to have a body which is both long and deep and in which the fin and rudder surfaces are unshielded by the tailplane.

All the other conclusions are of relatively minor importance except perhaps, in extreme cases, those relating to the yawing inertia effects. Consideration of the way in which the centrifugal yawing couple enters into spinning leads to the conclusions that:—

(2) Types of aeroplane in which the centrifugal yawing couple is harmful and of appreciable magnitude are:—

A. Monoplanes / Very highly staggered biplanes — With their big weights in the body (A–B negative and big).

B. Unstaggered biplanes with weights on wings. (A–B positive and big).

Similarly types in which the centrifugal yawing couple is helpful are:—

C. Monoplanes / Highly staggered biplanes — With weights in wings (A–B positive).

D. Unstaggered biplanes with large negative A–B. (Weights in body).

Conclusions regarding various minor effects are as follows, always remembering that what is classed as a minor effect may assume great importance when too little margin of safety has been allowed.

(3) The effect of slots is likely to be beneficial in spins of no very great incidence, but in flat spins the effect may be adverse and of quite serious magnitude. It is, therefore, of special importance in cases where slots are fitted that the possibility of the flat spin should be avoided.

(4) Seaplane floats are less likely to have an adverse effect on spinning in the unfavourable combinations, A and B, than in the good ones, C and D. In A the effect may even be good. Floats will, however, tend to raise the limits of incidence within which spinning is possible.

(5) The high wing monoplane is less liable to the flat spin than the low wing monoplane. A tentative conclusion is that raising the wing by a chord length reduces the maximum incidence of the spin by something of the order of 10°.

(6) Additions to the vertical fin area forward of the centre of gravity such as may be brought about by a change of engine, the addition of a Townend ring or wheel spats are likely to have an adverse effect in monoplanes and highly staggered biplanes and a good effect in unstaggered biplanes.

(7) A dihedral angle is almost certainly an advantage in types A and B *i.e.*, the unfavourable combinations, and disadvantageous in types C and D, the favourable combinations.

(8) Sweepback of moderate amount is probably bad in the unfavourable combinations and good in the favourable combinat ons.

(9) In the markedly favourable combinations:—

(*a*) Recovery is helped by moving the stick forward.
(*b*) A forward position of centre of gravity is favourable for recovery.
(*c*) Decrease in height favours recovery.

In the markedly unfavourable combinations all the above may be reversed

SILENCING AIRCRAFT. By A. H. Davis, D.Sc. R. & M. No. 1542. (10 pages and 8 diagrams.) September 28, 1932. Price 9d. net.

It is common knowledge that until comparatively recently the noise in the cabins of aircraft was so extreme that for many persons it constituted the chief deterrent to air travel. Conversation was wholly impossible, and often wads of cotton wool were issued to passengers to enable them to obtain some slight—but welcome—relief from the pandemonium of sounds, and to protect them in some measure from the period of perceptible deafness which followed an excursion by air. It is also generally known that the cabins of certain recent aircraft are so much quieter than those of earlier types that conversation is comfortably possible and no after deafness is noticeable. It is not so well known how such improvement has been attained and the necessary steps are indicated in this report.

From the Clubs.

THE LONDON AEROPLANE CLUB

Flying times for the week amounted to 37 hr. 25 min., Mr. E. Nothmann being a first soloist. Among new members the Club have pleasure in welcoming Mdlle. H. O'Donnell and Capt. Rocco, from Kenya. The "Tiger Moth" and "Puss Moth" have been in great demand over the week-end. Members are reminded that tickets for the annual dinner and dance are limited, so applications should be sent in as soon as possible.

BROOKLANDS

Owing to the fact that fog enveloped the aerodrome for the first half of the week, the flying hours only totalled 55 35 hr. dual and 20 hr. solo. Mr. Kitley did a very creditable first solo, and amongst new members who have joined during the week were Messrs. Fenn, Hodge, Harris and Flt. Lt. Dease, who is taking the instructor's course. Capt. McKenzie and Mr. Vivian have returned to the Club for refresher courses. Several students of the College of Aeronautical Engineering received instruction in a course which is not included in the college curriculum when they took part in the British International Pictures' next production, "The Secret Agent," which aroused great interest, partly by reason of the visit of Miss Greta Nissen.

HANWORTH (N.F.S.)

The B.A.C. "Drone," which is being shipped out to India as part of Capt. C. D. Barnard's Air Circus, has been tested in the workshops and dismantled. Mr. Beardmore's Junkers has also been turned out after re-painting, and is going out to Egypt for the International Meeting. Visitors to the Club during the week included Mr. Norman Blackburn with the Earl of Warwick, and the Earl of Ronaldshay. On Friday, November 24, Mr. Walters carried out successfully a test for his "A" licence. On Thursday, November 23, Flt. Lt. Wilson flew Mr. Moore, of the British International Pictures, Ltd., to Plymouth. Another film company, B.I.P. of Elstree, loaned a Desoutter for a film which is in production.

CINQUE PORTS FLYING CLUB

Poor weather has again spoiled the Club's weekly flying times, and only 20 hours have been recorded. Mr. F. Brown, one of the *Daily Express* scholarship winners, has passed his "A" tests during the week, as also has Mr. Alec Glenny, of Hythe. Bad weather prevented Mr. Maxwell-Norman from doing his night test for a "B" licence; he has had to return to business, and will await better conditions.

THE YORKSHIRE AEROPLANE CLUB

Thick fog and continual rain reduced the Club's flying times to about 5 hours for the week.

Approximately 200 guests were present at the Club's Annual Ball, held at the Hotel Majestic, Harrogate, on Friday, November 24. The appropriate aviation touch was given to the ballroom by the introduction of two wind indicators on lattice-work masts, and aeroplane propellers hung over the band. Among those present were the Mayor and Mayoress of Harrogate (Mr. and Mrs. J. H. Newsome), Mr. Turner Taylor, the Town Clerk of Harrogate, Lady Allerton, Capt. Nigel Fitzroy (Chairman) and party, and Capt. and Mrs. H. V. Worrall, the Club's Chief Pilot and Manager.

CARDIFF AERO CLUB

The flying times for the week amounted to 4 hr. 55 min. dual, 9 hr. 30 min. solo and 50 min. tests. A new associate member is Mr. W. G. Nicol, from Mombasa, and a first soloist Miss C. F. Armstrong.

READING AERO CLUB

The Club totalled 40 hr. flying during the last week, there being one first soloist, Mr. Ruddle. At the present moment there are 14 pupils under instruction, and new members were Mr. Robertson, of Vickers, Ltd., and Mr. Whatley, of the A.I.D., who is Air Ministry Resident Inspector at the Phillips & Powis works. The new demonstration Miles "Hawk," which is now flying, is being greatly admired; it has an exceptionally beautiful cellulose finish of a grey-green colour. Mr. Stephen Cliff's "Gipsy III Hawk" is nearly ready. Mr. Cliff hopes to start for Egypt on Sunday next to take part in the International Meeting; incidentally his machine possesses a closed cabin.

LIVERPOOL AND DISTRICT AERO CLUB

Flying returns for the week ending Friday, November 24, totalled 8 hr. 50 min. dual and 17 hr. 55 min. solo. Thick mists spread over the aerodrome during most of the week. It has been decided to start night flying from Wednesday, November 29. The annual ball will be held at the Grosvenor Hotel, Chester, on Friday, December 29.

NORTHAMPTONSHIRE

Weather during the week has been very bad, so that only 8 hours' flying have been done. The Club were delighted to welcome back Miss Doreen Tyzack, who has now recovered from her accident of the summer. The Club's next Crazy Party will be held on Friday, December 8, at the clubhouse.

NORFOLK AND NORWICH AERO CLUB

Last week was one of the best that the Club has experienced for a long time, from a flying point of view. Mrs. F. Crossley, Messrs. R. T. Ketton-Cremmer and G. F. R. Clarke had instruction from Mr. Collier, and Miss F. Henfrey took some advanced instruction. Soloists were Miss W. Hudd, Capt. J. D. Paul, Messrs. A. R. Kirkby, S. Hansel, A. J. S. Morris, J. B. Purefoy, A. R. Cox, H. C. Stringer and R. T. Ketton-Cremmer. The Club are pleased to welcome a new member in Mrs. F. Crossley, who has joined to learn to fly. The most pleasing event of the week was the engagement of the Club's Ground Engineer, Mr. A. Kirkby, to Miss F. Henfrey, who is a pilot member of the Club. A supper dance is being held at the Club on Friday, December 1, at 8.30 p.m.; Howard's Dance Band has been engaged and will play until 1 a.m. It would help if members would apply for tickets as soon as possible.

HERTS AND ESSEX AEROPLANE CLUB

The Club's flying times for the week totalled nearly 100 hr., over 20 hr. of which were flown on Sunday, November 26. The third competition for the "Woodside" Challenge Cup, presented by Mr. W. Saunders, was

"VULGARISING" AVIATION IN FRANCE: This little machine shown in this photograph is built to sell at 13,000 francs, thanks to M. Pierre Cot's subsidy. The engine is of 35 h.p., and the wing span is about 20 ft.

held on Sunday, November 26. There were 16 entries and the two three-point courses were well spread over Essex, which gave the competitors a good test in navigation. The winner was Mr. John E. Lowe, who has just completed his 100 hr. for an "A" licence at Broxbourne in the space of three months. He obtained 100 per cent. marks, being dead on time, accurate in spotting points and made a perfect landing after shutting off his engine at 2,000 ft. Mr. Lowe took advantage of the Broxbourne Contract scheme, whereby a member may contract for 50 hr. solo flying at £1 an hr. Mr. Eric Gay was second with 98½ per cent. and Mr. Kenneth J. Lindy third with 96 per cent. The winner holds the cup for six months when he is presented with a replica for retention. The cup was provisionally presented to the winner by Mrs. A. R. Frogley, but will be officially presented at the Club's Annual Dinner.

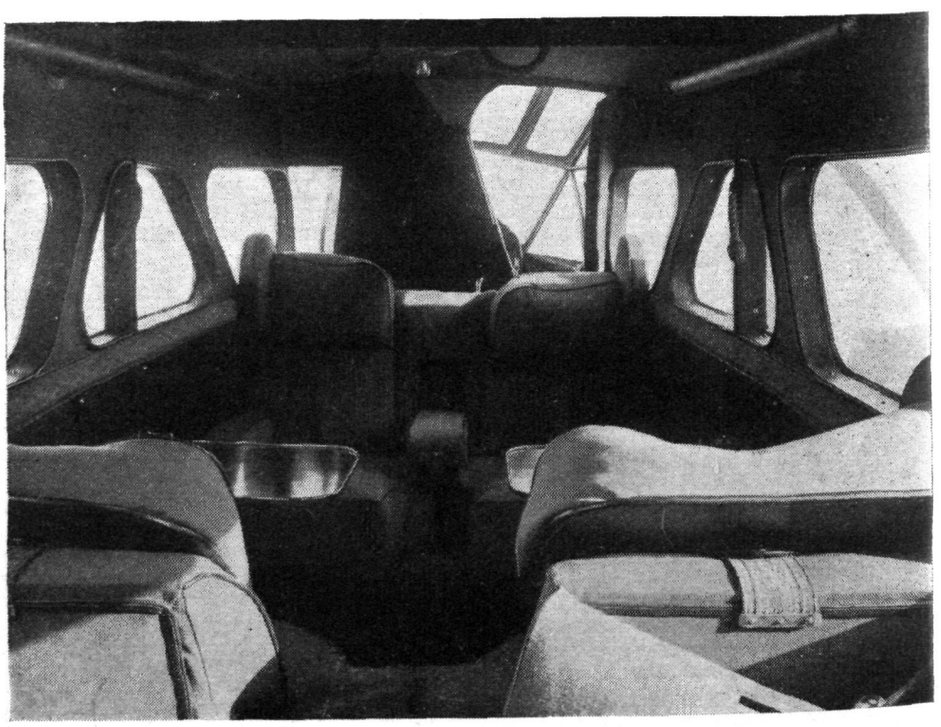
IRISH AERO CLUB

Despite rather unfavourable weather conditions, a total of nearly 59 hours was flown by the two D.H. "Moths" of the Club at Baldonnel Aerodrome during October. Although the flying time for November will be somewhat lower, preparations are being made to keep the organisation before the public eye, and a series of lectures is being arranged. Recently Mr. T. O'B. Kelly, the honorary secretary, did a good piece of propaganda work when he presided at a meeting of the Clontarf Literary Society, Dublin, which debated, on the motion of Mr. E. F. MacSweeney, the resolution "That the future prosperity of Ireland is dependent on the development of her air services." The motion was passed with a very large majority. Arrangements are also well in hand for the annual dance, which is to be held in the Gresham Hotel, Dublin, on December 28.

LONDON GLIDING CLUB

On Sunday, November 26, a north-easterly breeze again prevented the use of the hill-top, thus benefiting beginners who were instructed on the flat in a primary machine. After some hand-launches the *Prüfling* was hitched up to the launching-winch and given long hops. The *Willow Wren* and *Crested Wren*, being fitted with quick-release hooks, were subjected to the full violence of the winch, which shot them up to heights ranging from 250 ft. to 340 ft. They were thus able to make free flights of about 2 min. each, in which time one could either have a quiet run of about a mile or else indulge in a nice spiral. From data thus obtained, the sinking speed of the *Crested Wren* again appears to be a trifle over 3 ft. per sec. The *Willow Wren* had no aneroid and was not timed, but appeared to possess, under identical conditions, a slightly better gliding angle, as might be expected from her cleaner tail unit and greater immersion of the pilot in the fuselage. But for sweetness of control the older machine is ahead, her tail surfaces being smaller but perfectly adequate.

A LUXURY DRAGON



THESE two FLIGHT photos show the exterior and interior of a "Dragon" recently produced by the de Havilland Aircraft Co., Ltd., as an example of real luxury. The machine, which will doubtless be seen a good deal during the next few months, has its fuselage painted yellow, while the wings are aluminium finished. The interior gives extremely comfortable seating for four passengers, and the equipment includes a cocktail bar, and a large lavatory behind the cabin. The door of the latter is in the form of a roller blind.

Airisms from the Four Winds.

Fog the Enemy

IN connection with the mishaps in France last week to two of the Avro 626 machines now *en route* to Egypt, certain inaccuracies in the original reports are likely to have given a wrong impression of what happened, and it becomes advisable to place on record the actual facts. To begin with, the report published (not in FLIGHT) that engine trouble was a contributory cause is wrong. A report from Sqd. Ldr. Tait makes it clear that there was no blame whatever attaching to the Armstrong-Siddeley "Cheetah" engines. The accidents were caused solely by the difficulties of flying in conditions of very bad visibility. The machine whose occupants were killed was gliding in over a belt of trees to make a landing in what appeared to be a suitable field, when the pilot found an obstruction in the form of a line of high-tension cables. Being unable to "zoom" over the cables in time, he put the nose of his machine down in an effort to get underneath the cables. Before the pilot could get the nose up again the machine hit the ground at considerable speed, bounced and, on hitting the ground again, the petrol tanks burst. Had the pilot not broken formation, but remained with the formation, all would have been well, as le Bourget was reached safely. The second machine made a forced landing, ran into soft ground and turned over slowly. *It did not catch fire at all,* and was not "written off."

R.A.F. Re-placement flight

THE five Vickers "Victorias," which, as was reported in FLIGHT for last week, are flying out to Iraq to replace older machines of the same type, left Marseilles on Wednesday, November 22.

R.A.F. West African flight

THE three Vickers "Victoria" troop carriers, which are on a West African service flight, have arrived at Bathurst, Gambia.

The K-7 disaster

ON Wednesday, November 22, the Russian aircraft K-7, claimed to be the largest landplane in the world, crashed near Kharkhoff, 420 miles south-west of Moscow. Fourteen lives were lost. It is reported that M. K. A. Kalinin, the designer and director of the Kharkhoff aeroplane works, and Snegireff, one of the best-known pilots in Russia, are among the dead. It seems that sabotage is suspected by the authorities, for the O.G.P.U. (Soviet secret police) is represented on the commission of experts investigating the disaster. Twenty trial flights had been successfully made before the crash.

The design and construction of the K-7 took five years. She had a span of 208 ft., weighed about 20 tons and accommodated 120 passengers. She was considered to be a big stride forward in the approach to the "all-wing" aircraft, and most of the accommodation and equipment was in the wing. A few days before the accident the existence of the K-7 was revealed to the general public by "Pravda." It was declared that the aircraft represented a "victory of the utmost political importance," as she was constructed entirely of Soviet steel from the mills at Dniepropetrovsk. Hitherto Russia had relied on imported materials for her aircraft.

The Master of Sempill

A CABLE, sent by Mr. Gordon England to Lord and Lady Sempill, states that the Master of Sempill has made a wonderful recovery. He has suffered no disfigurement and his memory has not been impaired. He will, however, have to remain in hospital for a further few weeks.

Roumanian Cape flight abandoned

SHELL AVIATION NEWS informs us that the three Roumanian officers, mentioned previously in FLIGHT, have abandoned their flight to the Cape, and landed at Almaza Airport, Cairo (the home of Misr-Airwork), on November 10, on their return flight to Bucharest. A sandstorm, and later torrential rain, was encountered, and the Messerschmidt aeroplanes, which were of wooden construction, and had been somewhat dried up in Egypt, expanded to such an extent that certain parts had to be cut away to enable the controls to move freely. South of Malakai the whole country appeared like one vast lake, and it was then decided to return north.

The Oases meeting

WE give below the British entries for the Oases Meeting which is being held in Egypt from December 18-23. Among the other competitors are:—Four Egyptians, four Germans, one Italian, one Belgian, one Hungarian, one Algerian, one Yugoslavian, and 17 French.

R. E. Gardner, "Monospar" (two Pobjoy R's); W. Lindsay Everard, "Dragon" (two "Gipsy Majors"); S. B. Cliff, "Hawk" ("Gipsy III"); G. Robson, "Gull" ("Javelin"); A. Henshaw, "Swift" (Pobjoy R); Lady Hay Drummond-Hay, "Waco" (Continental); the Duchess of Bedford, "Monospar" (two Pobjoy R's); Sqd. Ldr. F. O. Soden, "Puss Moth" ("Gipsy III"); P. Randolph, "Gull" ("Gipsy Major"); N. M. Gazdar, "Gull" ("Javelin"); Sir Piers Mostyn, "Leopard Moth" ("Gipsy Major"); M. D. L. Scott, "Puss Moth" ("Gipsy III"); L. Beardmore, Junkers "F.13") ("Jupiter VI"); Turab Ali Khan Agha, "Puss Moth" ("Gipsy III"); W. D. Campbell, Avro 626 ("Cheetah"); Peake Pasha, "Moth" ("Gipsy II"); W. E. Davis, "Mouse" or "Leopard Moth" ("Gipsy Major"); E. D. Spratt, "Hawk" ("Cirrus III").

The European Rundflug, 1934

AT Warsaw, on November 20, a conference was held by the delegates of the Aero Clubs taking part in the International Rundflug for 1934. The course of 5,600 miles will be covered in competitions to take place between the end of July and the beginning of August. The following points will be touched:—Warsaw, Koenigsberg, Berlin, Cologne, Paris, Bordeaux, Pau, Madrid, Seville, Casablanca, Mekrès Sidi Bel Abbès, Algiers, Biskra, Tunis,

ON SAFARI—WITH A CINE CAMERA: The two Sikorski amphibians—*The Spirit of Africa* with giraffe markings, and *Osa's Ark* with zebra markings—in which Mr. and Mrs. Martin Johnson have been carrying out an aerial expedition in Central Africa filming animal life. (*Photo. Shell Aviation News.*)

JAPAN'S AUTOGIRO: This machine, *Aikoku* (Patriot) was presented to the Japanese Army by "National Patriotism." It is seen above during the "Ceremony of Contribution," held in Shinto style.

Palmero, Naples, Rome, Brindisi, Padova, Zagreb, Vienna, Brno (Brünn), Prague, Kattowice, Lodz, Wilno and Warsaw. Thus the whole French North African coast will be covered, and the machines will have to fly 125 miles over the open sea.

All Irvin's

THREE lives were saved by parachutes on Thursday, November 23; incidentally, all the parachutes used were of the Irvin type, which are, of course, standard equipment in the R.A.F. F/O. J. Summers, test pilot of Vickers (Aviation), and Mr. J. Radcliffe escaped from a machine when it broke up in the air. Reports state that there was an explosion and parts of the machine were seen falling earthwards. At Chadwell Heath P/O. I. G. MacKay left his machine, a Bristol "Bulldog," by parachute, after it had been injured by collision with another machine of the same type.

Lady Carlisle in air crash in China

THE Countess of Carlisle was injured in an air crash in Chusan Island, about 100 miles south of Shanghai, on Friday, November 24. According to reports, the machine, a Sikorsky amphibian, took off from Shanghai, but returned to the aerodrome on account of fog. Later it set out again, but encountered more fog in Hangchow Bay and turned back. It was during the return journey that the crash occurred, the machine flying into a hillside. The nine occupants had miraculous escapes. Lady Carlisle was the only woman in the machine. It is understood that she broke both ankles, injured her back, but is in no danger.

The Lindberghs

COL. AND MRS. LINDBERGH left Lisbon on Tuesday, November 21, and flew to Horta in the Azores, where they arrived the same afternoon. Two days later, Thursday, November 23, they flew back to Sao Miguel, and the next day, Friday, November 24, left Ponta Delgada in the Azores for Las Palmas in the Canary Isles. On Sunday, November 26, they flew from the Canary Isles to Villa Cisernos, in Rio de Oro.

Lord Londonderry's eastern tour

LORD LONDONDERRY, Secretary of State for Air, has arranged to spend the Parliamentary recess in visiting units of the Royal Air Force Overseas. The tour will be carried out entirely by air, and will include visits to Egypt and the Sudan, to Trans-Jordan and Iraq, and to India. The total distance to be flown is about 16,000 miles. The flight to Cairo will be made by the regular Imperial Airways Service, while between Cairo and Khartum and between the latter city and Baghdad the journey will be made in Royal Air Force machines. Lord Londonderry will rejoin the Imperial Airways service at Baghdad and complete the outward trip to Calcutta in their aircraft. After a week-end at Calcutta, where the Viceroy and Lady Willingdon will then be in residence, Lord Londonderry will go to Delhi, where the headquarters of the Indian Army and the Royal Air Force in India are situated. He will then proceed to visit the Air Force Stations in Northern India and on the North-West Frontier. These will include Ambala, Lahore, Peshawar, Kohat, Risalpur, Miranshah, Quetta, and finally Karachi. Royal Air Force aircraft will be employed on this part of the tour. From Karachi he will return to London by Imperial Airways. Lord Londonderry will be spending Christmas at Cairo, with Lady Londonderry and daughters, and during this period he will inspect the units in Egypt before he begins his main series of visits. Mr. C. A. C. J. Hendriks, M.C., Private Secretary to the Secretary of State, will travel with Lord Londonderry from Egypt onwards.

An Irish-Built monoplane

THE first aircraft to be built in the Irish Free State is nearing completion at Hazelwood, near Sligo, and its builder is Mr. Charles V. Foley, who has designed the machine himself. His principal object in constructing the monoplane is to demonstrate an emergency control device which he patented recently. This consists of an automatic slot in the elevator which will come into operation when the aircraft is flying in interrupted air currents or is accidentally put into a spin. Mr. Foley's aircraft is a high-wing monoplane with two open cockpits and powered by a "Cirrus III" engine, although he hopes to instal a larger power unit before the machine is sent to Baldonnel for its Certificate of Airworthiness. The overall length is approximately 23 ft., while the span is nearly 35 ft. The estimated top speed, which seems rather high, is 170 m.p.h., with a cruising speed of 140 m.p.h.

New flying boats for U.S. Coast Guard

THIRTY-ONE flying boats for coastal survey and rescue work are to be purchased by the U.S. Coast Guard. At present their fleet consists chiefly of twin-engined Douglas & General Aviation amphibians and flying boats.

American engines in Russia

AN agreement was made last April between Curtiss-Wright and the Amtorg Trading Co., the Soviet representatives in the United States, for the manufacture, under licence, of Wright "Cyclone" 700-h.p. and Curtiss "Conqueror" 650-h.p. engines. For some months from ten to fourteen Soviet engineers have been studying at the works of the Wright Aeronautical Corporation, at Patterson, N.J. The location of the plant in Russia which will produce the engines has not yet been announced, but it seems that twenty American engineers will go to Russia to supervise construction.

A wireless beacon for Le Bourget

THE French Air Ministry is equipping Le Bourget with a wireless beacon for "blind" landings. This will be in addition to the "location" wireless beacon already installed. Similar arrangements have recently been made at Schipol, Tempelhof and Zurich.

French "attack" machines

FRANCE, like America, is developing a type of machine expressly for "attack" work. The "Dyle et Bacalan 20," built by the Société Aérienne Bordelaise, and fitted with four Lorraine "Courlis" engines, has, since September, 1933, had modifications made to its structure, and in its new form has recently been flown to Villacoublay for tests. A new Potez attack machine is being built at a cost of 400,000 francs. This type will be fitted with two Hispano Suiza 12 Xbrs. engines and a retractable undercarriage. The estimated top speed is 186 m.p.h.

Airport News.

CROYDON

I HEAR that Marconi Wireless Telegraph Co., Ltd., have carried out some interesting tests in short-wave wireless telephony between the Croydon Airport experimental station of the company and a Bristol "Bulldog" single-seater fighter flying in the neighbourhood of Bristol and Cardiff. The aeroplane was fitted with a fixed aerial and a Marconi A.D.43/44A transmitting and receiving equipment. Excellent communication was maintained between Croydon and the aeroplane flying over Filton (Bristol), Newport, and Cardiff. The ground station equipment used at Croydon was type A.D.37A, which, it is interesting to note, is giving such excellent results on the Imperial Airways African service with "Atalanta" type aeroplanes.

A visitor to the Airport during the week to excite considerable interest was the Royal Dutch Air Lines "FXX" Fokker, the first machine of its size to have a retractable undercarriage. After the take-off the pilot, Mr. Smirnoff, brought the machine back over the aerodrome with the undercarriage retracted, and it is certainly difficult to imagine cleaner lines than those of the "FXX" in these circumstances. The pilots (Mr. Soer accompanied Mr. Smirnoff on the second visit) say that the aeroplane is everything they could desire from a flying point of view, but that they were obliged to readjust quite a number of their "routine" ideas to the extra speed. For example, to fall into the trap of asking for a weather report of Croydon at a certain usual position would mean reaching the airport almost before the reply had been obtained. Several observers got quite a creepy feeling on seeing one wheel slowly disappear into the engine nacelle whilst the other was still down. As one onlooker remarked, "It seems against nature somehow." We of the Terminal Airport must be excused if we look upon aeroplanes as almost human. One gets like that after long years in their company.

Film stars seem to do all their travelling by air these days. Lili Damita arrived by Imperial Airways, Ltd., from Paris on Monday, November 20. She was, it is said, to take a leading part in "Contraband," but she decided not to do so, and returned to Paris on the Friday. Camilla Horn, the German star, was 'phoned for to take the part, and flew from Berlin to London by D.L.H. on the Wednesday.

Two Indian private owners landed here early in the week, having flown quietly through from Karachi in their private aeroplane, taking 20 days over the trip. They were Messrs. T. H. Dastur and J. B. Patel. They came to this country to do a course at Air Services Training, Ltd., at Hamble, the former for his Navigation and the latter for his "B" licence.

Both Sir John Simon and Mr. Anthony Eden, those veteran air travellers, made use of Imperial Airways' lines during the week. There was also Sir John Maffey from Uganda by the same company; Sir Auckland Geddes, outward bound for Broken Hill; and Sir Herbert Stanley, who flew from London to Capetown.

We have seen little of the sun for the past week or so, but the air traveller often gets what we on the ground do not. A passenger whom I spoke to last week as I shivered on the dank tarmac under a chill grey sky told me that he had just spent a couple of hours or so on an inward flight high above the mist and murk in bright sunshine and blue sky. From above, he said, the bank of dirty cloud was a sunlit mass of dazzling whiteness like a snowscape. Passengers are always amazed by the beauty of a flight above the clouds, and it is remarkable that the air companies do not make more publicity out of this particular subject.

A. VIATOR.

FROM HESTON

THE British Air Navigation Company took delivery last week of a 4A.T. three-engined Ford monoplane which they will use for luxurious regular services and charter trips. The machine will be fitted with wireless, and the cabin arrangements include a form of settee which will make for greater freedom of movement for the passengers. It is comforting in some weather to know that you *can* lie down if you feel that way!

Mr. A. E. Guinness's 5A.T. Ford was engaged at Heston during the early part of last week.

In the thick weather, Capt. Birkett, whose job in life requires him to get through almost anything so that the public may have its bird's-eye view in the morning paper, was the only aeroplane on the scene on November 19, when the pit disaster happened at Grassmoor, and one newspaper made a special edition of the pictures that he brought to London. He carried wireless, which was of some assistance, as the fog got worse during the difficult flight back to Heston.

A new aerodrome south of London

THE chain of aerodromes round London, situated outside the area where fog is most prevalent, will be greatly strengthened by the addition of one lying two miles from Redhill and south of those hills which are an obstruction to aircraft when approaching London and flying under the clouds in conditions of bad visibility. The application to develop the land for the purpose of an aerodrome was opposed by the Rural District Council of Godstone, but on appeal to the Ministry of Health, it has been decided that the aerodrome scheme may proceed, subject, of course, to detailed plans being approved by the authorities concerned. A public inquiry was conducted by an Inspector from the Ministry of Health, evidence being taken from the local Council, the owner of the estate, the neighbouring residents, Mr. G. C. H. Last, managing director of British Air Transport, Ltd., and the prime mover in the scheme, together with that from experts in aviation matters, including Sir Alan Cobham and Maj. R. H. Mayo. The site consists of several fields lying at an average altitude of 200 ft. above sea level and served by a good road. These fields will be merged into one open area, drained and levelled, prior to the application for a licence to fly. The site is the best in the neighbourhood of Redhill and Reigate. A first-class aerodrome will be constructed, and this will be in a position of great value to serve the large residential district lying within easy reach by road and also of use as one of the emergency landing grounds around London for pilots from the Continent when unable to proceed further north owing to bad weather. It is hoped to have the aerodrome ready for use by the late spring or early summer of next year. When completed, an area of more than 100 acres will be available, giving landing runs in every direction of at least 700 yards.

The Airports Conference

BOTH Lord Londonderry, the Secretary of State for Air, and Sir Hilton Young, Minister of Health, will speak at the Mansion House on December 8 on the occasion of the Airports Conference, which is being convened by the London Chamber of Commerce in conjunction with the Royal Aeronautical Society, and is to be opened by the Prince of Wales. Among those who have accepted invitations to the Conference are: The Duke of Sutherland, the Earl of Haddo, Chairman of the Greater London Regional Planning Committee, Lt. Gen. Sir George Macdonogh, President of the Federation of British Industries, Sir Josiah Stamp, Chairman of the London Midland & Scottish Railway, and Mr. Gerald Loder, Chairman of the Southern Railway. The Lord Mayors of Birmingham, Bristol, Hull, Nottingham, Stoke-on-Trent, and the Lord Provost of Perth will be present, whilst other towns to be represented include: Brighton, Hove and Worthing, Cardiff, Carlisle, Crewe, Edinburgh, Gloucester and Cheltenham, Greenock, Halifax, Harrogate, Leicester, Llanelly, Manchester, Margate and Ramsgate, Norwich, Preston, Swindon, Torquay, Worcester and York. From the replies received, it is evident that there will be a large attendance of representatives of municipalities from different parts of the country. Lord Wakefield of Hythe, who has done so much for the cause of British civil aviation, is giving a dinner to the delegates after the Conference, when the Secretary of State for Air will be the principal guest.

Correspondence.

The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.

TOWED GLIDERS

[2899] May I refer to Sir Alliott Verdon-Roe's letter in this week's issue of FLIGHT.

As the filmed incident to which Sir Alliott refers did not take place in Great Britain, I am writing to correct an erroneous impression which may have been formed in some minds that it occurred within the British gliding movement.

The British Gliding Association, in endeavouring to carry on the gliding movement in this country with safety as its first consideration, is very alert to the necessity of keeping the movement as free from serious accidents as lies in its power, and in this respect rules and regulations governing auto-towing and aeroplane-towing gliders have been in force for the past two years.

In these rules special provision is made which requires that a "fool-proof" quick release shall be fitted to the towing car/aeroplane and glider, which is easily operable by the instructor in the car, or by the aeroplane pilot, at the one end, and by the glider pilot at the other.

In drafting these rules, the B.G.A. Technical Committee went at great length to gather practical information, which enabled them to cover every possible contingency. Most of it was supplied by the late Jimmy Lowe-Wylde, with whose activities in towed gliding many of your readers are familiar. Capt. Frank Hawks also supplied much evidence regarding the spectacular "jazzing" up of gliding by the Americans which they attempted to do without the necessary experience or equipment. In several instances their attempts resulted in such deaths as no doubt occurred in the film under discussion.

In Great Britain towed gliding is practised by most of the gliding clubs, and I am glad to be able to report that no serious accidents have occurred so far.

Publishing a film of this nature must be very harmful, not only to the gliding movement, but to aviation as a whole, and I am making efforts to obtain its withdrawal.

Will Sir Alliott Verdon-Roe accept my Council's thanks, in advance, for drawing attention to this matter, as up to the time his letter appeared I was unaware of the film's existence.

J. L. R. WAPLINGTON
(Hon. Sec., The British Gliding Association, Ltd.)

London, W.1.
November 25, 1933.

CONTROL OF FLIGHT NEAR CROYDON IN BAD VISIBILITY

[2900] The institution of the above regulations has the following two important effects on the use of light aeroplanes between the Continent and London.

(1) A light aeroplane leaving, say, Paris, on satisfactory weather report, times its departure therefrom for arrival before darkness at, say, Heston. Fog conditions in the Croydon area materialise during transit. The private machine (unequipped with radio) must then *either* deviate round the control, in which case he risks arriving after dark, *or* he must land at an aerodrome outside the control to obtain navigation instructions. In the latter alternative, as regulations stand at present, the machine must pass Customs before proceeding to Heston. At present the only aerodrome equipped with Customs for this purpose is Lympne, and even there—from my experience on 12 recent Customs clearances—the average delay for Customs purposes alone has been 25 min. This means that a private owner cannot go on without risking landing *in* the dark *under* conditions of bad visibility, and he is, therefore, delayed for the night. At other aerodromes surrounding the zone, such as Penshurst, West Malling and Gravesend, no Customs are provided, and so the delay is greater.

It will be appreciated, therefore, that under present conditions the effect on private owners is either to endanger their lives or to reduce their average flying speed between Paris and Heston by at least 25-35 per cent. according to cruising speed.

To overcome this difficulty, may I suggest:—

(1) That inward-bound aircraft which land on English aerodromes, outside the area, *exclusively for the purpose of obtaining navigation instructions,* be permitted to take off again immediately without Customs, and to clear at their originally-intended Customs aerodrome.

(2) That as soon as conditions of bad visibility occur, all the outlying aerodromes be automatically provided with navigation instructions for aircraft landing, so that these can be transmitted to the pilot immediately and *without* his stopping his propeller (while he telephones to Croydon for news).

(3) That an extra code group of numbers be added to those used by Croydon for the transmission of weather reports to Continental aerodromes, which group means "fog conditions in force at Croydon zone." By this means private owners planning to leave the Continent for London will be automatically aware of the conditions and will time their departure in cognisance of delays which the conditions call for.

(4) Pending the institution of arrangements as described above, can resident Customs be immediately instituted at Penshurst, West Malling, Gravesend, Canterbury and Gatwick?

A. B. GIBBONS.

London, E.C.2.
November 27, 1933.

A "Caterpillar" wrist-watch

A WATCH which cares nothing for shocks, falls, or water is just the watch which many people have been wanting for years. Messrs. G. & M. Lane & Co., Ltd., of 24-26, Ludgate Hill, have produced a wrist watch which is always tested for 24 hours under water before it is sold. They also claim that falls have no effect upon its workings, and, to give this claim a thorough test, the Chief Photographer of FLIGHT was requested to take one of these watches up in an aeroplane and throw it overboard. The experiment was made over Brooklands aerodrome, and the watch, completely unprotected, was dropped from a height of 2,000 ft. It lay in wet grass for over an hour before it was picked up, and it was found to be still ticking merrily, and not even the glass was cracked. It has since continued to keep perfect time. This sounds a tall story, but it is absolutely true.

More M.G. records

THE Magic Midget, the super-racing version of that sporting little car so beloved by aeroplane pilots, has, in the hands of Capt. G. E. Eyston, once again brought several records to Britain. On November 20, on the Montlhery track he covered:—50 km. at 115.00 m.p.h.; 50 miles at 114.47 m.p.h.; 100 km. at 113.50 m.p.h.; 100 miles at 111.17 m.p.h.; and in one hour travelled 110.87 miles, thus creating five new international Class H records. All with an engine of less than one-litre capacity, yet it takes us over six litres to push quite a small aeroplane through the air at the same speed!

London-Cairo Air Route book

THE Aviation Department of the Automobile Association have just issued an Air-Route Book for the London-Cairo route. This is available at 1s. 6d. to members, and similar books, covering other routes, are in the course of preparation. It shows, very clearly, indeed, all the formalities which pilots have to comply with when undertaking journeys on any particular route. It gives the distances between aerodromes and alternative tracks, together with information as to the advantages and disadvantages of each particular track. As the conditions on these routes are continually changing, modifications to the books will be made immediately they become necessary. Members will thus be able to obtain an up-to-date edition at any time.

THE MARCONI "HOMING DEVICE"

THE Marconi "homing" device provides one of the simplest possible methods of wireless navigation for large or small aircraft flying over territory where ground wireless direction-finding stations do not exist. It is compact and light, which does away with any objections on the score of weight and bulkiness.

If an aircraft is already fitted with a modern type of Marconi receiver the "homing" device can be fitted to it as a small extra attachment, and as the type of receiver required to be used in conjunction with "homing" device is comparatively light and compact, this system of wireless navigation is equally suitable for the smaller type of privately owned machines and for the heavier classes of passenger carrying machines.

The "homing" device is fitted as an attachment to the new Marconi combined medium and short-wave transmitting and receiving equipments installed in the "Atalanta" type of aircraft used by Imperial Airways for their African and Indian routes.

To enable a machine to carry out "homing" it is fitted with a suitable receiver, or a small attachment to its existing Marconi equipment, and a loop antenna around the wings or fuselage in addition to the normal trailing aerial.

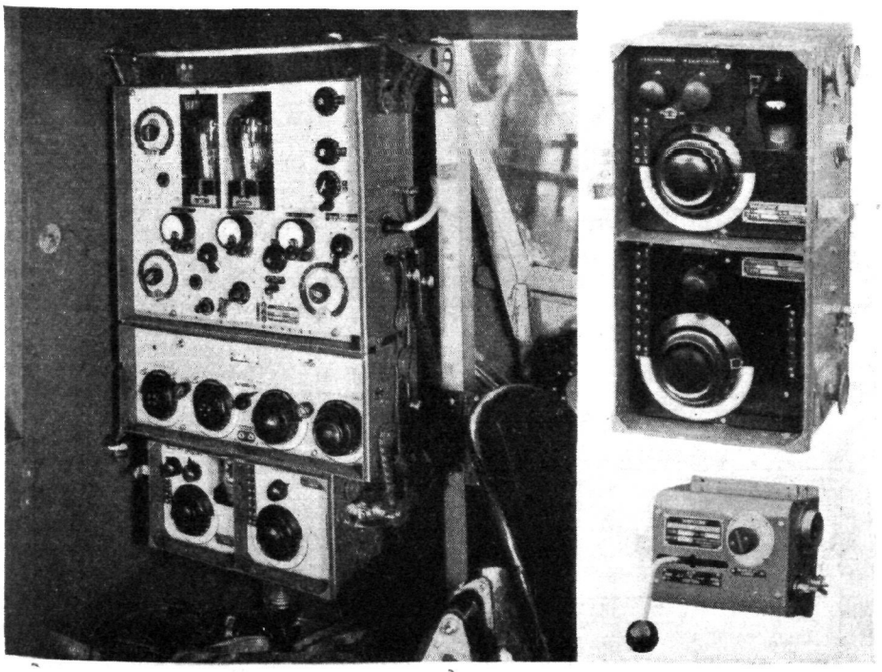
The operation of the "homing" device is quite simple. There is a three-position switch which, if placed in the middle position, connects the loop aerial alone to the receiver; if placed in the left-hand position, both the loop and the trailing aerial are connected to the receiver; and if placed in the right-hand position, both the loop and trailing aerials are again connected to the receiver, but the connections are reversed. When the aeroplane is flying directly towards a transmitting station, and the loop only is connected to the receiver—that is, with the switch in the middle position—no signals will be heard in the telephones, since the plane of the loop is at right angles to the direction from which the signals originate. As a check the pilot can place the switch in the right and left-hand positions, when it will be found that owing to the action of the trailing aerial signals of equal strength are received. If the nose of the machine veers away from the direct line to the transmitting station, a signal is heard even when the switch is in the central position, through the action of the loop aerial. On switching to the left or right, signals of different strength are heard, indicating to the pilot the direction of his deviation. He can then correct his course until signals in the right and left-hand positions of the switch are again at equal strength. As an additional check again, the switch can be placed back in the middle position, when no signals should be heard.

To give some technical details. The wave range of the "homing" device covers 550-1,550 metres, which includes not only all the wavelengths allotted by international regulations to aviation services, but also the principal ship wavelengths and those used by coastal wireless stations, and a number of the European broadcasting stations on the longer broadcasting waveband. The attachment proper comprises a high-frequency amplifier unit having two panels, on one of which is mounted a Type S. 610 screen grid high-frequency amplifying valve and the component parts for tuning and amplifying the incoming signals. The tuning condenser is calibrated directly in metres to facilitate adjusting the circuits to the required wavelength. With the apparatus used in conjunction with a standard type of Marconi aircraft receiver, advantage can be taken of a two-position switch mounted on this panel by means of which the trailing aerial can be connected either directly to the normal receiver or through the extra stage of high-frequency amplification provided for in the attachment, thus giving increased selectivity during normal reception. On the second panel is mounted a circuit for tuning the loop aerial for the "homing" device to the required wavelength. A "D.F. Receiver" switch mounted on this panel connects the loop aerial and the high circuit for frequency amplifier into direction-finding purposes when the switch is in the "D.F." position, regardless of the setting of the two position switch on the first panel. As a thought-saving device the two side positions for the switch are marked "turn port" and "turn starboard" respectively, so that the pilot can have no doubt as to his correct procedure.

Apart from the weight of the loop aerial, which varies somewhat according to the design of the aircraft on which it is installed, but which is often of the order of some 5 lb. (2¼ kg.), the addition of complete direction finder "homing" apparatus to an existing receiving or transmitting-receiving installation involves an increase in weight of only 14 lb. (6¾ kg.). The dimensions of the direction finder attachment itself are 14½ × 7½ × 7½ in. (36.8 × 19 × 19 centimetres), while those of the reversing switch unit are 5¾ × 5 × 4 in. (14.6 × 12.7 × 10.2 centimetres).

When required the "homing" device can be supplied complete with receiver (either in one case or two separate cases, as most suitable) to form a combined direction-finder-receiving equipment.

An example of the utility of "homing" for light aircraft was provided on Mr. John Grierson's recent flight over a portion of the North Atlantic, to quote his own words from *The Times*. "The advantages offered by 'homing' wireless have decided me to employ this method on all future long-distance flights." Imperial Airways report that, under service conditions, this "homing" device, fitted to the "Atalanta" class, has acquired a range of 250 miles.



THE MARCONI-ROBINSON "HOMING" DEVICE: The "Homing" device is shown, on the left, fitted as an attachment to a Marconi Type A.D. 37a/38a equipment in an Imperial Airways' "Atalanta" class machine. It is the small attachment below the radio receiver. The complete "Homing" device is shown on the right, the tuner and high-frequency amplifier being above and the switch unit below.

COLLEGE OF AERONAUTICAL ENGINEERING

THE annual Dinner and Dance of the Automobile Engineering Training College and the College of Aeronautical Engineering was held at Grosvenor House, London, on November 22.

Mr. C. H. Roberts, the chairman, after proposing "the loyal toast," spoke on behalf of the Automobile and Aeronautical industries, to which he referred as the two finest and most go-ahead industries in the world. He announced that Lord Wakefield had consented to become the first President of the colleges, and this announcement was very naturally received with the greatest enthusiasm. He referred to the extension of the activities of the colleges, together with an increase in the premises, which had taken place during the past year, this latter being a large annexe which had been opened for the second year automobile students, and which had doubled the floor space. Furthermore, the new large hangar (which has frequently been referred to in FLIGHT) had been opened at Brooklands, and now accommodated all the aeronautical students of the aircraft section during the more advanced stages of their training.

Of particular importance was the Careers side of the Colleges, and it was gratifying to know that all the Automobile Diploma students who required assistance had been placed in positions, while all the past students who had applied to the college had also been assisted.

The affiliation scheme of training for the aeronautical students was now being put into practice, and some of the first students enrolled in this section had already been transferred for specialised training to aerodrome, operating, and manufacturing companies. The extent of the detailed and practical experience which these students received before transferring to the companies was shown by the fact that in the college aero engine shop there were 56 engines of 20 different types, of which 12 were supercharged. In this shop some 160 complete overhauls had been carried out, of which 53 were on engines of over 450 h.p. During the year 35 students sat for the Associate Fellowship examination of the Royal Aeronautical Society and 25 passed. Eleven students sat for the Institution of Automobile Engineers' examination and all passed.

The first holder of the Kathleen Drogheda Trophy, which the Countess of Drogheda presented to the Automobile College last year, to be held annually by the student possessing the best all-round record for the year, was Mr. R. E. Daniell, and the first holder of the Mollison Trophy, presented by Mr. and Mrs. Mollison to the Aeronautical College for the student possessing the best all-round record of the year, was Mr. J. G. Brown.

The Chairman also rejoiced that some members of the Houston-Mt. Everest Flight were present at the dinner (it will be remembered that Col. P. T. Etherton, the organiser of the Flight, is also a Director of the College). The members presented two autographed copies of their book "First over Everest" to the students who were senior after the Trophy holders. These were Mr. J. E. Belcher, of the Automobile College, and Mr. R. N. Wimshurst, of the Aeronautical College.

Lord Howe replied for the Automobile Industry and Mr. F. Handley Page for the Aeronautical Industry. Thereafter Mrs. Shelmerdine presented replicas of the trophies, and Col. F. C. Shelmerdine (Director of Civil Aviation), in his short and particularly happy speech, congratulated the winners.

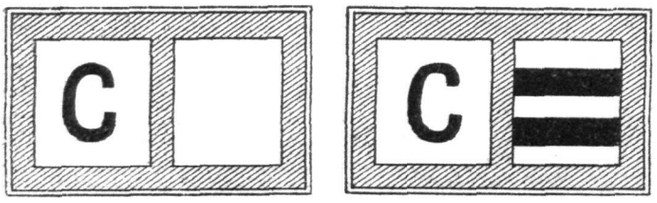
THE MOLLISON CHALLENGE TROPHY: This Challenge Trophy has been presented by Mr. and Mrs. J. M. Mollison to be held by the student of the College of Aeronautical Engineering securing the highest standard of general efficiency each year. The holder for 1933 is Mr. J. G. Brown.

The Royal Aero Club monthly house dinner

THE Royal Aero Club monthly house dinner will be held on Wednesday, December 6, at 8.15 p.m. Mr. Arthur Elton, of the G.P.O. Film Unit, will present the film "Aero Engine." This film was made by Mr. Elton for the Empire Marketing Board to illustrate the trades and crafts involved, and the individual skill of English craftsmanship in aircraft engineering. Dinner 4s. (Dinner jackets.) Members intending to be present are requested to send their names to the House Secretary beforehand.

Award to Mr. Mollison

THE Guild of Air Pilots and Navigators have decided to award the Johnston Memorial Trophy for the year 1933 to Mr. J. A. Mollison in recognition of his navigation of the North and South Atlantic. The Trophy is to be presented to him on Monday, December 4, at the Skinner's Hall. Mr. Mollison is at present on his way home; his wife will follow him when she has fully recuperated.



"THICK OR CLEAR!" These are the "bad visibility notices" displayed on the Manston, Lympne and Littlestone aerodromes, referred to on page 1181 of last week's issue—and which, unfortunately, got "pushed" out of the text!

A fine record

MOVIETONE NEWS are showing a fine record of Air Marshal Balbo's Formation Flight, at the Movietone News Theatre, Shaftesbury Avenue, this week. There are perhaps many omissions which will be regretted by people whose "meat and drink" is aviation, but nevertheless Movietone have done fine work to piece together such an excellent film. Our readers will have followed the flight stage by stage as it went across Europe and over to America via the Greenland and Canadian route, and as it returned across the Atlantic to Lisbon and so home. Now they will be able to see the "Armada," as it is called, landing at and taking off from many of these places. Some of the shots from the air, particularly those showing this great fleet at anchor at various harbours, are magnificent, and the spontaneous vivacity with which the Italian Commander-in-Chief, his officers and crew were greeted at every stopping place is shown to be genuine enough. Not only is the film excellent propaganda for Italian aviation, but should act as a tonic to spur others on. A prologue and epilogue to the film are told by Sir Alan Cobham in his usual inimitable style.

Posters wanted

IN connection with a dance which is being given on H.M.S. *Glorious* in December, it is desired to "disguise" the hangar as a civil airport, and to this end attractive posters are required, showing different types of aircraft, air route and air line advertisements, etc. Will any readers of FLIGHT who have such posters to spare send them to Lt. N. de G. Waymouth, R.N., H.M.S. *Glorious*, c/o G.P.O., London. Up to 1,000 posters are needed for the decorative scheme which the organisers have in mind.

THE ROYAL AIR FORCE

London Gazette, November 21, 1933.

General Duties Branch

G. H. Gatheral is granted a short service commn. as Pilot Officer on probation with effect from and with seny. of Nov. 1. The follg. are granted short service commns. as Acting Pilot Officers on probation, with effect from and with seny. of Nov. 7 :—S. G. Birch, C. C. Byar, A. B. Dreghorn, C. L. Gomm, C. C. Hodder, P. S. Hutchinson, W. O. Jones, J. C. M. Lonsdale, V. H. P. Lynham, R. G. Musson, R. G. Seys, R. G. Slade, J. M. Southwell, W. N. Stubbs.

Capt. F. H. A. Harrison, R.A.R.O., is granted a short service commn. as Flt. Lt. on the Supplementary List, with effect from Sept. 25 and with seny. of Jan. 17, 1919. (Substituted for *Gazette* Oct. 3.) Acting Pilot Officer on probation H. Stanton is confirmed in rank and graded as Pilot Officer (Sept. 9). The follg. Pilot Officers are promoted to rank of Flying Officer :—C. H. B. Bullock (March 19) ; H. R. Allen, W. J. Craig, W. McA. McAulay, E. G. Thompson (Sept. 11) ; J. J. Watts (Oct. 4) ; R. G. Bowditch (Oct. 8) ; A. W. Langton, H. M. Russell (Oct. 11).

Sqdr.-Ldr. W. H. Dunn, D.S.C., is placed on half-pay list, scale A (Nov. 8) ; Flt. Lt. A. E. Rogenhagen is placed on retired list at his own request (Nov. 15) ; Lt. Comdr. W. S. Lea, R.N., F/O., R.A.F., relinquishes his temp. commn. on return to Naval duty (Dec. 19, 1932) (substituted for *Gazette* Dec. 20, 1932).

Accountant Branch

Flt. Lt. F. H. Wakeford is placed on retired list at his own request (Nov. 9).

Medical Branch

The follg. Flt. Lts. are promoted to rank of Squadron Ldr. :—R. W. White, M.R.C.S., L.R.C.P. (Nov. 12) ; G. P. O'Connell, M.B., B.Ch., A. Dickson, M.B., Ch.B., F.R.C.S. (E) (Nov. 19).

ROYAL AIR FORCE RESERVE

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

P/O. on probation A. L. Maidens is confirmed in rank (Nov. 3). The follg. F/O. relinquish their commns. on completion of service :—R. W. Steele (July 8) ; J. A. C. Florence (Sept. 15).

The follg. Flying Officers relinquish their commns. on completion of service and are permitted to retain their rank :—E. P. Smith (Oct. 30) ; A. R. M. Brain (Nov. 15).

P/O. S. G. Birch relinquishes his commn. on appointment to a short service commn. in R.A.F. (Nov. 7).

AUXILIARY AIR FORCE

General Duties Branch

No. 600 (City of London) (Bomber) Squadron.—F/O. D. L. Doyle relinquishes his commn. on completion of service (Oct. 11).

No. 601 (County of London) (Bomber) Squadron.—P/O. C. G. Hohler is promoted to rank of Flying Officer (Sept. 7).

No. 603 (City of Edinburgh) (Bomber) Squadron.—F/O. G. H. Gatheral relinquishes his commn. on appointment to a short service commn. in the R.A.F. (Nov. 1).

AUXILIARY AIR FORCE RESERVE OF OFFICERS

General Duties Branch

D. L. Doyle is granted a commn. as Flying Officer in Class A (Oct. 11).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified :—

General Duties Branch

Group Captains : S. W. Smith, O.B.E., to R.A.F. Base, Singapore, 10.11.33, on appointment as Officer Commanding, Far East Command, and to Command R.A.F. Base, Singapore, vice Group-Capt. A. H. Jackson. R. E. Saul, D.F.C., to No. 203 (F.B.) Sqdn., Basrah, Iraq., 26.10.33, to Command, vice Group-Capt. W. L. Welsh, D.S.C., A.F.C.

Wing Commander : H. S. Powell, M.C., to Station H.Q., Hinaidi, 6.11.33, to Command, vice Wing-Com. R. F. S. Morton.

Squadron Leaders : R. W. Chappell, M.C., to No. 1 (F.) Sqdn., Tangmere, 12.11.33, to Command, vice Sqdn.-Ldr. C. B. S. Spackman, D.F.C. G. H. Cock, M.C., to No. 23 Group H.Q., Grantham, 13.11.33, for Personnel Staff duties, vice Sqdn.-Ldr. C. Boumphrey, D.F.C.

Flight Lieutenant : J. H. C. Wake, to No. 503 (County of Lincoln) (B.) Sqdn., Waddington, 13.11.33.

Flying Officer : G. R. White, to No. 504 (County of Nottingham) (B.) Sqdn., Hucknall, 14.11.33.

Accountant Branch

Squadron-Leader R. Byrne, M.C., to H.Q., Mediterranean, Malta, 10.11.33, for duty as Command Accountant.

Medical Branch

Flight Lieutenants : P. H. Perkins, to Station H.Q., Heliopolis, 20.10.33. R. Thorpe, to R.A.F. General Hospital, Palestine and Transjordan, 20.10.33.

Dental Branch

Flight Lieutenant W. D. Guyler, to R.A.F. Base, Malta, 10.11.33.

NAVAL APPOINTMENT

The following appointment has been made by the Admiralty :—

Lieut. H. C. Ranald (F/O., R.A.F.), re-attached to R.A.F., and apptd. to *Victory* for R.A.F. Base, Gosport (December 10) ; and to *Barham* (January 11).

No. 17 (Fighter) Squadron R.A.F. & R.F.C. Reunion Dinner

It has been decided to hold a Re-Union Dinner of past and present officers of No. 17 (Fighter) Squadron, R.A.F., and No. 17 Squadron, R.F.C. The provisional date decided upon is the second week in February, 1934. Past and present officers who are interested are requested to communicate with Flight-Lieutenant E. S. Borthwick-Clarke, No. 17 (F) Squadron, Royal Air Force, Upavon, Marlborough, Wilts.

Manorbier Landing Ground—Pembroke

Manorbier landing ground is now available for landplanes visiting the R.A.F. Station, Pembroke Dock. The landing ground is situated 8 miles east of Pembroke Dock near Manorbier Station on the Pembroke-Tenby Railway, 1 mile north of the " t " in Jameston on the Ordnance Survey map ¼ in. to 1 mile, R.A.F. edition, sheet 7. Manorbier Station is marked but not named. It is 2 miles north of the village of Manorbier. Cattle will normally be grazed on the landing ground. In order to allow the ground to be cleared and transport to be sent out from Pembroke Dock, 48 hours' warning of intended use is to be given to the C.O., Pembroke Dock, stating probable requirements of petrol and oil and the duration of the visit. Owing to lack of facilities, visits are not to extend overnight save in exceptional circumstances, and then only with the concurrence of the C.O., Pembroke Dock.

Class " B " Pilot's Licences : Medical Re-examination Facilities at Sealand and Leuchars

An Air Ministry Notice to Airmen states that the arrangements under which pilots requiring medical re-examination for renewal of Class " B " Pilot's licences may in certain cases be re-examined at the Royal Air Force Station, Sealand, instead of at the Central Medical Establishment, London, have recently been extended to the Royal Air Force Station, Leuchars.

Pilots desiring to avail themselves of these special facilities either at Sealand or Leuchars are requested to apply to the Secretary (C.A.2), Air Ministry, at least 14 days before the intended date of examination.

Where the medical history of the applicant presents special features, the Air Ministry may, however, require the re-examination to be undertaken at the Central Medical Establishment, London.

Cancellation.—Notice to Airmen, Series A. No. 34, of 1933, is hereby cancelled.

S. Smith & Son's general meeting

The 19th ordinary general meeting of S. Smith & Sons was held at Cricklewood on Thursday, November 23. Mr. W. Henderson-Cleland, M.C., the Chairman, said that the profit on trading for the year was £131,663, which was an increase of just over 53 per cent. on the profits for last year. This increase was brought about by the general expansion of trade. The company claimed that it had more than maintained its position during the year, and had now established itself as not only the largest makers of motor-car and aircraft instruments in Europe, but also as the largest manufacturers of domestic or household clocks in this country. The directors felt that the time had come when recognition should be made of the services of the staff, and they proposed to put that recognition into the most practical form by inaugurating a pension scheme on a contributory basis for all members of the staff. The directors proposed to transfer £30,000 from the general reserve to the Pensions Fund, and it was intended to put the scheme into operation at once.

No. 605 Squadron entertains

The Officer Commanding No. 605 (County of Warwick) (Bomber) Squadron, The Right Hon. Viscount Bearsted, M.C., and the Officers entertained friends and guests at Castle Bromwich on the evening of Tuesday, November 21. The squadron's drill hall had been transformed into a ballroom for the occasion, and over 200 members of the squadron and guests were present. Before dancing began, Sqd. Ldr. A. C. Wright and Mrs. Wright held a reception. During the evening Sqd. Ldr. Wright received many congratulations on his squadron's success in winning the Esher Trophy for the fourth time. Dancing was carried on until midnight, when a very well attended eggs and bacon parade was held. Incidentally, the whole scene during dancing was extremely picturesque, the drill hall being well decorated and the many coloured uniforms very effective.

AIRCRAFT COMPANIES' STOCKS AND SHARES

ALTHOUGH during the past month sentiment in the stock and share market has been under the influence of uncertainties as to the outcome of the American currency developments and the volume of business has been on a reduced scale, shares of companies operating in the aircraft and allied industries remained steady. In sympathy with market conditions there have been moderate declines in some instances, but in others there were movements in favour of holders on balance, and, generally speaking, the greater part of the substantial rises made in recent months have been maintained. De Havilland continued to benefit from the view that the report (which may be published towards the end of next month) will show improvement, with possibly a larger dividend. Fairey Aviation, on the other hand, experienced a certain amount of profit taking. At the time of writing they are 25s. 9d., compared with 28s. 9d. a month ago. In view of market anticipations of larger profits, hopes of the dividend being more than 10 per cent., tax free, remain current. In respect of the year to September 30, 1932, 26 per cent. net could have been paid, so that if the company has earned increased profits, it would be possible to raise the dividend and at the same time continue the conservative policy of putting a large amount back into the business. The dividend will probably be declared about the middle of December. Hawker Aircraft shares, which have a nominal value of 5s., moved up further from 16s. 6d. to 17s. 6d., aided by market reports that the company is doing well. It may be recalled that the prospectus indicated that for the three years ending March last average profits showed earnings of over 25 per cent. on the ordinary shares. This explains why the shares are quoted at several times their nominal value, for if profits are maintained, 12 per cent. could be paid and a large sum left for reserve allocations, etc. Imperial Airways have been very steady throughout, their favourable long-term prospects being widely recognised. There has been less business in Napier issues; the 7½ per cent. preference moved in favour of holders, as their next half-yearly dividend is payable at the end of December. Armstrong-Siddeley Development preference also improved. The report, which is usually issued towards the end of December, is expected to show that preference dividend requirements are again covered with a good margin. Last year the dividend on the 6½ per cent. first preference was earned nearly three times over, and 10 per cent. paid on the ordinary shares. In other directions, Joseph Lucas have been dealt in actively since they went "ex" the 100 per cent. share bonus, and S. Smith (M.A.) issues were well maintained on the excellent results and the resumption of dividends on the deferred shares. Brown Brothers were in demand on market reports that the company's business is continuing to grow, and British Oxygen came in for a good deal of attention on favourable views of prospects and the dividend outlook.

Name	Class	Nominal Amount of Share £	Last Annual Dividend %	Current Week's Quotation
Anglo-American Oil	Deb.	Stk.	5½	102½
Armstrong-Siddeley Develop	Cum. Pref.	£1	6½	23/9
Birmingham Aluminium Castg.	Ord.	£1	7½	29/3
Booth (James), 1915	Ord.	£1	15	73/3
Do. do.	Cum. Pref.	£1	7	28/–
British Aluminium	Ord.	£1	5	28/1½
Do. do.	Cum. Pref.	£1	6	24/–
British Celanese	Ord.	10/–	Nil	14/–
British Oxygen	Ord.	£1c	6½	45/–
Do. do.	Cum. Pref.	£1c	6½	28/9
British Piston Ring	Ord.	£1	20	70/6
British Thomson-Houston	Cum. Pref.	£1	7	28/9
Brown Brothers	Ord.	£1	10	46/3
Do. do.	Cum. Pref.	£1	7½	29/–
Dick (W. B.)	Cum. Pref.	£10	5	117/6
De Havilland Aircraft	Ord.	£1	2½	27/–
Dunlop Rubber	Ord.	c	4	37/7½
Do. do.	"C" Cum.Pref.	16/–	10	28/–
En-Tout-Cas (Syston)	Def. Ord.	1/–	Nil	–/6
Do. do.	Ptg.Ptd. Ord.	5/–	Nil	2/7½
Fairey Aviation	Ord.	10/–	10*	25/9
Firth (T.) & John Brown	Cum. Pref.	£1	6D	13/–
Do. do.	Cum. Pref.	£1	5*D	12/9
Ford Motor (England)	Ord.	£1	Nil	22/–
Fox (Samuel)	Mt. Deb.	Stk.	5	82½
Goodyear Tyre and Rubber	Deb.	Stk.	6½	104
Handley Page	Ptg. Pref.	8/–	10	11/3
Hawker Aircraft	Ord.	5/–	B	17/6
Do. do.	Red.Cum.Pref.	£1	B	20/7½
Hoffmann Manufacturing	Ord.	£1	5	26/3
Do. do.	Cum. Pref.	£1	7½	27/6
Imperial Airways	Ord.	£1	5	33/–
Kayser, Ellison	Ord.	£5	1	62/6
Do. do.	Cum. Pref.	£5	6	100/–
Lucas (Joseph)	Ord.	£1	25E	55/6
Napier (D.) & Son	Ord.	5/–	Nil	7/3
Do. do.	Cum. Pref.	£1	7½	24/4½
Do. do.	Pref.	£1	8A	20/–
Petters	Ord.	£1	Nil	7/6
Do.	Cum. Pref.	£1	7½G	13/9
Roe (A. V.) (Cont. by Armstrong-Siddeley Devel., *q.v.*)	Ord.	£1	—	—
Rolls-Royce	Ord.	c	10	66/3
Smith (S.) & Sons (M.A.)	Def. Ord.	1/–	25	4/6
Do. do.	Pt.Pfd. Ord.	£1	14	46/3
Do. do.	Cum. Pref.	£1	7½	28/9
Serck Radiators	Ord.	£1	12½	38/3
"Shell" Transport and Trading	Ord.	£1	7½*	51/10½
Do. do.	Cum Pref.	£10	5	£12
Triplex Safety Glass	Ord.	10/–	25	76/3
Vickers	Ord.	6/6	4	8/1½
Do.	Cum. Pref.	£1	5*	22/7½
Vickers Aviation (Cont. by Vickers, *q.v.*)	—	—	—	—
Westland Aircraft (Branch of Petters, *q.v.*)	—	—	—	—

* Dividend paid, tax free. c £1 unit of stock. D Last xd. March, 1931. A Last xd. September 1931. B Issued this year. G Last xd. July 19, 1932. E Also 100% share bonus.

BRIEFLY

WELLWORTHY, LTD., piston-ring and piston specialists, have opened a second service depôt in Manchester. The existing depôt is at 1-3 Greengate, and the new one, which will open early in January, will be at 232, Deansgate. Wellworthy's also have service depôts in London, Birmingham, Bristol and Glasgow.

D. LEWIS, LTD., of 124, Great Portland Street, has appointed two new foreign agencies: Sweden and Finland, H. Vilen, 16, Odinvagen, Diursholm, Sweden; and India: French Motor Car Co., Ltd., 233-4, Lower Circular Road, Calcutta, India. This means that the company is now represented in Belgium and Northern France, Holland and the Dutch Colonies, Sweden and Finland, India and Portugal.

PUBLICATIONS RECEIVED

Rolls-Royce Aero Engines. Rolls-Royce, Ltd., 14-15, Conduit Street, London, W.1.

Empire Communication. By Prof. E. V. Appleton, D.Sc., F.R.S. The Norman Lockyer Lecture, 1933. The British Science Guild, 6, John Street, Adelphi, London, W.C.2. Price 1s.

First Over Everest. The Houston-Mount Everest Expedition, 1933. By Air Commodore P. F. M. Fellowes, D.S.O., L. V. S. Blacker, O.B.E., Col. P. T. Etherton, and Sqdn. Ldr. The Marquess of Douglas and Clydesdale, M.P. London: John Lane The Bodley Head, Ltd. Price 12s. 6d. net.

By Air. By Sir Harry Brittain. London: Hutchinson & Co., Ltd. Price 12s. 6d.

NEW COMPANIES REGISTERED

BRITISH LION BUILDING CO., LTD.—Capital £1,000 in 700 8 per cent. preference shares of £1 and 6,000 ordinary shares of 1s. each. Objects, to acquire lands and buildings, to carry on the business of operators, proprietors, charterers, designers, builders, and letters on hire of aircraft, motor-boats and cars, etc.; to promote and encourage aerial navigation, to afford facilities for instruction in matters appertaining to aviation, etc. Directors: Wm. A. C. Kingham, 44, Lloyd's Way, Beckenham, Kent, director and secretary of International Airlines, Ltd.; Edith Kingham, 44, Lloyd's Way, Beckenham, Kent, stenographer.

AIRCRAFT EXCHANGE & MART, LTD, 7, Park Lane, W.1.—Capital £15,000 in £1 shares. Acquiring the business of aeroplane factors, agents and manufacturers, and instructors of aeronautics, carried on by W. B. Brady and A. L. T. Naish, at 7, Park Lane, W., and elsewhere. Directors: William B. Brady, 10, Oxford and Cambridge Mansions, W.; Alan L. T. Naish, 41, Hartington Road, Chiswick, W.4. Secretary: F. C. Troughton.

PATENT AERONAUTICAL SPECIFICATIONS

Abbreviations: Cyl. = cylinder; i.c. = internal combustion; m. = motors (The numbers in brackets are those under which the Specification will be printed and abridged, etc.)

APPLIED FOR IN 1932

Published November 30, 1933

15,053 L. R. UNDERWOOD and E. A. GASS. Two-stroke compression ignition engines. (401,024.)

19,801 ARMSTRONG SIDDELEY MOTORS, LTD., S. M. VIALE and D. PRIOR. Supercharger driving gear for i.c. engines. (401,058.)

25,532. Z. W. DAW. Rotary i.c. engine. (401,081.)

30,648. SVENSKA AKT. GAS-ACCUMULATOR. Beacons. (401,104.)

36,692. H. E. KEMPTON. Rotary engines. (401,130.)

APPLIED FOR IN 1933

Published November 30, 1933

8,412. H. L'ORANGE and SIMMS-MOTOR UNITS, LTD. Liquid-fuel injection pumps for compression-ignition i.c. engines. (401,171.)

9,500. SOC. GEN. DES CARBURATEURS ZENITH. Fuel injection pumps for i.c. engines. (401,177.)

12,859. E. G. BUDD MFG. CO. Welding. (400,939.)

19,613. F. KRUPP GERMANIAWERFT AKT.-GES. Supercharged four-stroke-cycle i.c. engines. (401,239.)

Personals

PREPAID
(18 words or less 3/6, then 2d. per word).

To be Married.

ROBERTS : MOORE.—The marriage arranged between FLIGHT-LIEUT. DAVID N. ROBERTS, R.A.F., and MISS RUTH A. MOORE will take place at Holy Trinity Church, Cookham, Berks, on December 9, at 2.30.

GRINDELL : OAKES.—The marriage between MR. GORDON GRINDELL, R.A.F., and MISS DOROTHY OAKES will take place quietly at Chelsea Old Church on Saturday, December 9, at 12 noon.

Births.

DICKSON.—On November 11, 1933, at Edinburgh, to MAY, wife of FLIGHT-LIEUT. ALEXANDER DICKSON, F.R.C.S.Ed., R.A.F. Medical Service—a daughter.

DUNCAN.—On November 17, 1933, at Axminster, Devon, to DORIS, wife of FLIGHT-LIEUT. J. DUNCAN, R.A.F. (retired)—a daugher.

MISCELLANEOUS ADVERTISEMENTS.

Advertisements for this column should arrive at this office by **Monday, 12 o'clock noon.**

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PATENT AGENTS

STANLEY, POPPLEWELL & FRANCIS, Chartered Patent Agents, 88-90, Chancery Lane, London, W.C.2. Telephone : Holborn 6393. Established 1879. z

A. P. THURSTON & CO., Chartered Patent Agents, 329, High Holborn, W.C.1. Tel. : Hol. 1117.

F. J. CLEVELAND & CO., Chartered Patent Agents, 29, Southampton Buildings, London, W.C.2. Telephone : Holborn 5875-6. z

KINGS PATENT AGENCY, LTD., 146A, Queen Victoria Street, E.C.4.—"Advice Handbook" and consultations free. 47 years' references. 'Phone : Central 0682.

GEE & CO. (H.T.P. Gee Patent Agent for Great Britain, U.S.A., Canada, etc., Mem. Rad. S.G.B., A.M.I. Rad. E.), 51-52, Chancery Lane, London, W.C.2 (two doors from Govt. Patent Office). 'Phone : Holborn 1525. Handbook Free.

SITUATIONS VACANT

SENIOR DRAUGHTSMAN for Aeronautical work. Full details of experience, age and salary required, to—Box No. 4229, c/o FLIGHT, 36, Great Queen Street, Kingsway, London, W.C.2.

VACANCIES exist for men with experience of Aircraft Repair Schemes, Spare Part and Illustrated Schedules, and D.I.S.—Apply, SHORT BROS., Rochester, stating age, experience and salary required.

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MISCELLANEOUS

AUSTRALIA.—Ex-Air Mechanic offers £30 for passage out.—Box No. 4238, c/o "FLIGHT," 36, Great Queen Street, Kingsway, London, W.C.2.

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AIR TAXIS

AIR TAXIS, LTD., Air Port of London, Croydon, Surrey. 'Phone : Fairfield 4101. Night 'Phone : Wallington 3491.

TUITION

THE INTERNATIONAL CORRESPONDENCE SCHOOLS offer sound instruction in Aeroplane Design, Fitting and Rigging, and Aero-Engine Fitting and Rigging; also expert training for Ground Engineers (Categories A, B, C and D). All instruction is by correspondence. Write to-day for our "Aeronautical Engineering" Booklet.—**INTERNATIONAL CORRESPONDENCE SCHOOLS, LTD.,** Dept. 182, International Buildings, Kingsway, London, W.C.2.

IMPORTANT.

MANY QUALIFIED "B" Licence Pilots can obtain Positions in the future if they hold the Air Ministry's Wireless Licence. Pilots who intend taking up Flying as a career should first train for the Air Wireless Licence.

The recognised Training Centre, with all the necessary equipment, is THE LONDON TELEGRAPH TRAINING COLLEGE, LIMITED (Founded 1896), of 20, Penywern Road, Earl's Court, London. Telephone : FLAxman 8721.

AERONAUTICAL ENGINEERING

AERONAUTICAL ENGINEERING TRAINING

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Syllabus from
THE COLLEGE OF AERONAUTICAL ENGINEERING
Chelsea, S.W.3

FIVE FIRST PLACES.
A REMARKABLE ACHIEVEMENT.
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